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KEJIMKUJIK NATIONAL PARK

RESOURCE DESCRIPTION AND ANALYSIS

Editor

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Kejimkujik National Park

1 September 1986

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Cliff Drysdale,

Park Ecologist,
Kejimkujik National Park

September 1986

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INTRODUCTION

The Role of Kejimkujik National Park in the National Parks System of Canada:

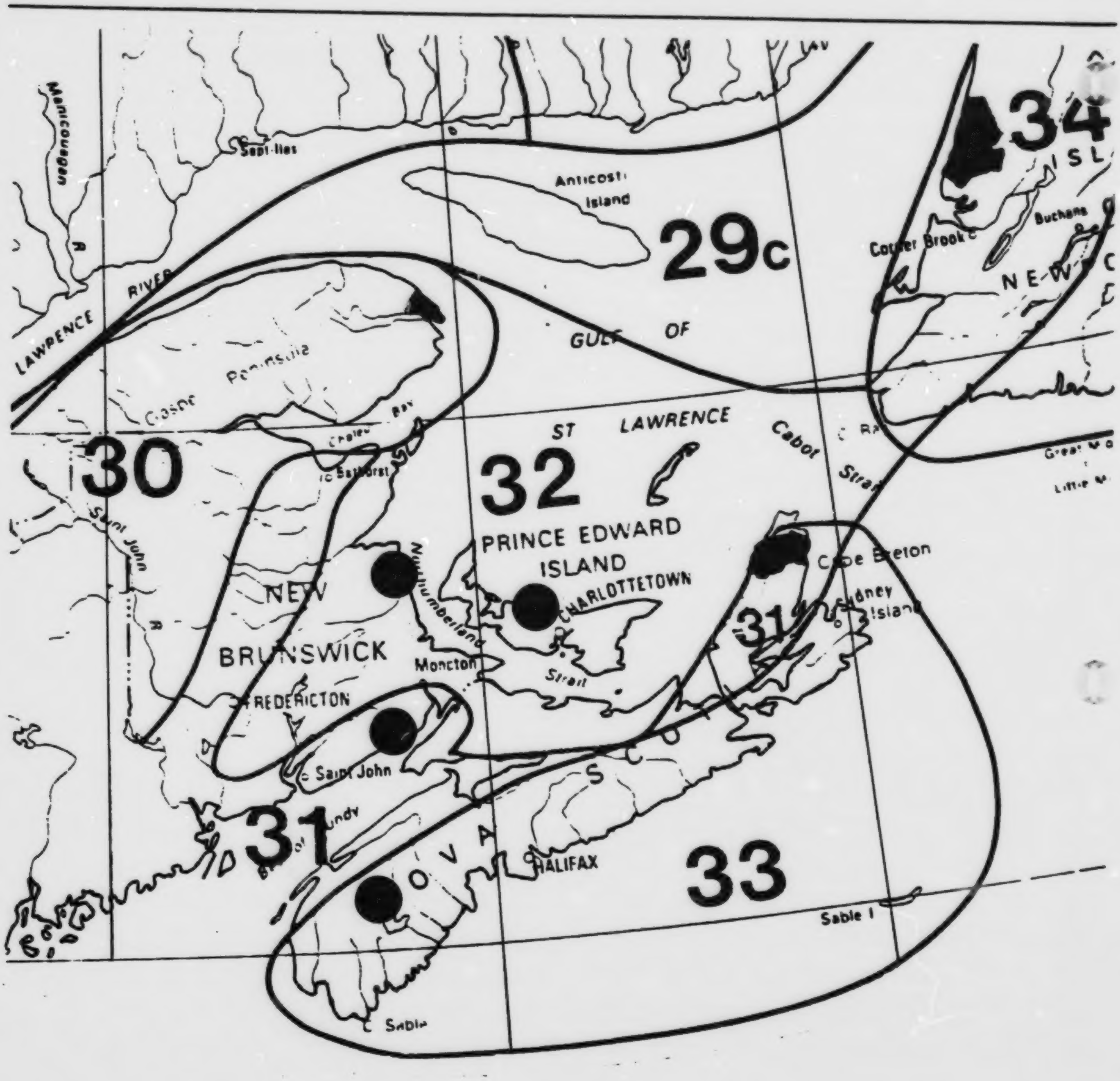
Thirty-nine terrestrial and nine marine natural regions have been identified in Canada. Parks has as an objective the protection of representative areas of Canadian significance within each of these natural regions.

Established in 1967, the 381 square kilometer Kejimkujik National Park is representative of the interconnected lakes, streams and low rolling topography of inland Nova Scotia--an area identified as the Atlantic Coast Uplands Natural Region (Fig. 1). The role of the Park in the National Parks System is to protect a designated portion of this area under the authority of the National Parks Act for the "benefit, education and enjoyment of present and future generations".

The Character of Kejimkujik National Park:

The forest cover of the Park is representative of the Atlantic Uplands forest region, including mixed coniferous and deciduous vegetation. While much of the forest has been disturbed by past logging, superb stands of large old growth Hemlock and Sugar Maple - Yellow Birch may still be found.

The coastal plain flora, a group of plants including the rare and endangered Water Pennywort normally found south of Canada, are an important Park resource. Similarly, the habitats of two rare reptile species are also protected in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Bathurst
32
PRINCE EDWARD ISLAND
CHARLOTTETOWN
Northumberland Strait
NEW BRUNSWICK
Moncton
FREDERICTON
Saint John
Bay of Fundy
31
Cape Breton
Sydney Island
NOVA SCOTIA
HALIFAX
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Figure 1 Atlantic Terrestrial Natural Regions

30	Notre Dame - Megantic Mountains (91,758 km^2)
31	Maritime Acadian Highlands (41,684 km^2)
32	Maritime Plain (37,224 km^2)
33	Atlantic Coast Uplands (36,963 km^2)

Natural Region 33 is represented by Kejimkujik National Park.

KEJIMKUJIK

Kejimkujik National Park. These are the Ribbon Snake and the Blanding's Turtle, both normally found in the south-central portion of continental North America.

The Park is rich in wildlife, due in part to the mixed nature of the forests and the varied habitat available. The presence of numerous lakes and rivers also contributes to the biological productivity. The Common Loon epitomizes the spirit of wildness in Kejimkujik and serves also as a measure of our ability to protect the natural resources of this unique area.

Kejimkujik lies in the centre of a traditional Indian canoe route between the Bay of Fundy and the Atlantic Coast. The earliest inhabitants of Kejimkujik were Maritime Archaic Indians, present from about 4,500 years ago. The nomadic Woodland Indians were next to inhabit the area, utilizing seasonal campsites along rivers and lakeshores. The Micmac Indians are descendants of these people. Petroglyphs are one remaining trace of the Micmac's life in the Park.

European occupation followed but while a few farms were cleared in the eastern part of the Park, logging and gold mining also played an important role in the history of Kejimkujik. In the early 1900's the area became important as a focus of outdoor recreation, a use which continues today.

Today the land, water, forest and historical resources of Kejimkujik, coupled with Park facilities, provide visitors with an opportunity to experience a quiet environment and help foster an appreciation for nature and the ways of our forefathers. The protection and management of resources also permits the use of Kejimkujik by educators and scientists, thus contributing to the advancement of modern society.

Collectively, these natural and cultural resources, combined with present land use, form the character of Kejimkujik National Park.

Park Objectives:

The Park objectives defined below were originally identified in the Kejimkujik National Park Management Plan (Parks Canada, 1978). They outline targets to strive for and provide a focus for future planning and research. Specific information of importance in formulating the objectives includes resource data, trends in visitor use, interpretive opportunities, regional relationships, as well as comments from the public. National Parks policies and objectives of the National Parks System as a whole also provide guidance. Park objectives are also established to give direction to the effective operation and maintenance of the Park.

The Park objectives are:

- To protect the natural resources of the Park from impairment by man, ensuring perpetuation of the natural features and processes characteristic of the lakes, streams, land forms, and flora and fauna of the Atlantic Coast Uplands Natural Region.

- To protect representative examples of the human heritage resources that are important for presenting the story of man's presence and activities in the Park.

- To provide opportunities for education, appreciation and awareness of the natural and human heritage resources within the southern interior of the Atlantic Coast Uplands Natural Region of Nova Scotia in general, and Kejimkujik National Park in particular.

- To provide a diversity of outdoor recreation opportunities compatible with the character of the Park, and to encourage visitors of varying interests and skills to experience and enjoy the Park.

- To operate and maintain the Park in order to maximize public safety and convenience in the use and enjoyment of the services and facilities; achieve optimal environmental quality and resource protection and fulfill departmental objectives of Parks Canada.

- To promote and encourage the establishment of land uses, developments and activities adjacent to the Park that are compatible and complementary to those within the Park.

Natural Resource Protection and Management:

As a consequence of the establishment of general objectives for the management of Kejimkujik National Park a series of sub-objectives were also developed to deal with the more specific requirements of natural and cultural resource protection and management (Parks Canada, 1978). These are as follows:

a. To minimize human impact on the Park resources in order to insure their perpetuation in an unimpaired state, with special emphasis on Zone I and II areas where fragile, rare and examples of all representative resource features are located.

b. To minimize human impacts on the natural processes in the Park in order to insure these forces will continue, while recognizing that some management is desirable in designated areas in order to establish and maintain a quality natural environment to maximize visitor safety and to maintain a diversity of flora and fauna in the Park.

c. To conduct and encourage selected research in order to expand the present knowledge of the natural environment of the Park, the ecological and evolutionary changes taking place, and the effects of human activities and development.

d. To protect the important human heritage resources from damage by man or nature; including the Indian petroglyphs, archaeological sites, and remnant examples of human activities characteristic of European settlement in the Park area.

The Role of This Document

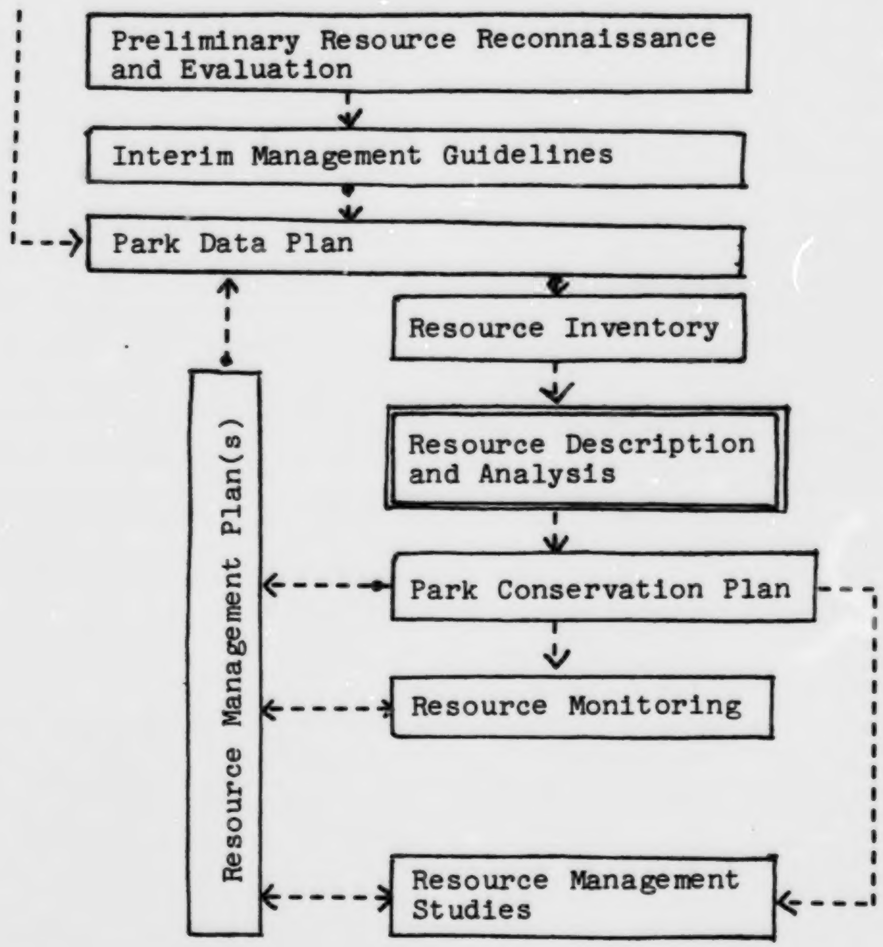
This document, termed the Kejimkujik National Park Resource Description and Analysis (R.D.A.), is one step in a systematic resource management planning process. The Natural Resource Management Planning Process is Environment Canada's approved framework for ensuring the protection and wise use of the natural and historical resources within National Parks. It came into use in 1979 and is outlined in Figure 2.

In the context of National Parks, natural resource management is defined as those activities directed toward the maintenance of biotic and abiotic resources of a Park in order to achieve stated objectives of preservation and/or use. Such objectives are guided by the National Parks Act, Parks' policy, and appropriate resource management practices.

The initial step in the planning process, that of resource inventory, has largely been completed for Kejimkujik, in the form of a biophysical land classification, and surveys of geology, limnology, avifauna, vegetation, mammals, herpetiles, archaeology and numerous other smaller inventory and study programs.

This Resource Description and Analysis is a digest and analysis of information gathered in the resource inventory, and studies carried out by Park staff and other researchers. It highlights major resource issues and concerns and promotes an understanding of the natural processes. The document will constitute the primary resource management input to overall Park management and serves as a reference document for ongoing management applications. Additionally, this document serves as a method to make accessible detailed resource information on Kejimkujik National Park at low cost to the interested public, educational institutions and research groups.

Fig. 2 Resource Management Process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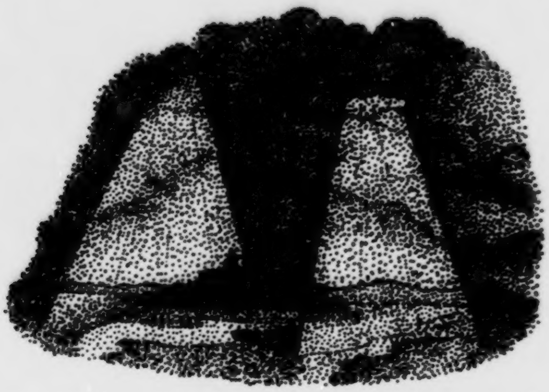
Interim Management Guidelines
Park Data Plan
Resource Inventory
Resource Description and Analysis
Park Conservation Plan
Resource Monitoring
Resource Management Studies
Resource Management Plan(s)

CLIMATE



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Description:

The climate of Nova Scotia is dominated by continental air masses moving from west to east. Since air reaching the region has usually had a previous history over the continent, the mean annual range of temperature is about twice as great in Nova Scotia as it is on the west coast.

On the other hand, moist maritime air often produces mild spells in winter, and periods of cool weather in summer. (DOT, 1960.)

Kejimkujik National Park, located midway in the south-western peninsula, is as far from the sea as is possible in Nova Scotia. While the mean temperature (Table A-1) for Kejimkujik does not appear to be significantly different from other areas, a closer look at detailed records indicates that the Park is a part of a climatic pocket which may account for the existence of some of the more rare flora and fauna (Bleakney, J.S., 1958). Winter temperatures tend to be colder and summer temperatures higher at Kejimkujik than along the coast.

Table A-1 Mean Annual Temperatures

Station	C°
Halifax	7.5
Saint John	5.8
Moncton	5.3
Charlottetown	6.0
Kejimkujik National Park	6.5

Source: Atmospheric Environment Services, 1982.

The Seasons:

For the purposes of outdoor recreation, the year is divided into summer and winter. Summer can be thought of as three units: the spring shoulder season which starts when frost begins to leave the ground, and lasts two weeks; high summer, when mean daily maximum temperatures reach $18^{\circ}C$ and above; and a cooling period, the fall shoulder season (Kejimkujik National Park Resource Atlas, 1976).

Tables A-2 and A-3 summarize data for a period of 15 years. The Warden Service supplies this data to the Atmospheric Environment Service.

Kejimkujik will normally attain high summer a month before the coast, and lies in the zone having the longest period of high summer in the province, lasting well into September (Dept. of Dev., 1973).

On the other hand, frost sufficient to destroy vegetation can occur in all months except July (Table A-2). Even though daytime temperatures are high enough for plant growth the frost free period averages only 94 days as compared to Kentville (138 days) or Halifax (171 days). The last frost of spring can be expected around June 5 (latest record, June 26). The first frost of fall occurs around September 12 (earliest recorded July 31). (Atmospheric Environment Service, Averages and Extremes, 1982.)

Watson (1973) indicates that Kejimkujik Lake is usually frozen over by Christmas, and free of ice by April 15.

He also indicates that summer water temperatures are only a few degrees cooler than the air, and therefore offer only slightly cool breezes during summer. All of the lakes in the Park are shallow and tend to respond fairly quickly to fluctuations in air temperature.

In general, then, the climate of Kejimkujik is more extreme in terms of temperature than coastal areas which are ameliorated by the maritime influence. Further, monthly fluctuations in temperature between highs and lows appear to be extreme as compared to many other stations in Nova Scotia. The frost free period can be very short, and growing degree days fewer than at Kentville or Halifax. Daily maximum temperature may reach the low 30's, which is uncomfortably hot when associated with high humidity. Despite this, nighttime temperatures in June and August can drop to below freezing.

Precipitation:

Total annual precipitation is the sum of the annual rainfall plus one-tenth of the annual snowfall. Figures A-1 to A-5 indicate the duration of snow cover. Table A-2 gives the average figures for precipitation at Kejimkujik.

Table A-2 Records of Temperature and Precipitation, Kejimkujik National Park

Kejimkujik Park
44°26'N 65°12'W 127m

	Jan.	Feb.	Mar.	Apr.	May	June
Daily Max. Temp.	- 0.7	- 0.6	3.5	9.6	16.1	21.4
Daily Min. Temp.	- 9.2	-10.5	- 5.6	- 0.7	4.2	9.3
Daily Mean Temp.	- 5.0	- 5.6	- 1.1	4.5	10.2	15.4
Standard Dev., Daily Mean Temp.	1.7	1.9	1.8	1.4	1.4	1.0
Extreme Max. Temp.	15.0	15.0	20.0	24.4	33.3	32.2
Years of Record	13	15	15	15	15	15
Extreme Min. Temp.	-27.8	-30.6	-25.0	-15.6	- 7.8	- 2.0
Years of Record	13	15	15	15	15	15
Rainfall	90.7	63.3	79.2	89.2	95.5	80.5
Snowfall	61.2	58.5	52.2	17.6	1.7	0.0
Total Precip.	156.0	126.1	127.7	103.9	97.1	80.5
Standard Dev., Total Precip.	61.0	49.1	20.8	35.7	37.3	40.5
Greatest Rainfall in 24 Hours	49.5	53.0	45.7	60.0	62.2	46.7
Years of Record	13	15	15	15	15	15
Greatest Snowfall in 24 Hours	30.5	30.5	25.0	20.3	17.8	0.0
Years of Record	13	15	15	15	15	15
Greatest Precip. in 24 Hours	53.6	53.0	45.7	64.8	62.2	46.7
Years of Record	13	15	15	15	15	15
Days with Rain	7	4	7	9	11	9
Days with Snow	10	8	6	2	0	0
Days with Precip.	15	11	12	11	11	10

Note: Rainfall in mm, snowfall in cm, total precipitation in mm, temperature in °C.

From A.E.S. records, 1982.

Table A-3 Records of Temperature and Precipitation, Kejimkujik National Park

	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
Daily Max. Temp.	24.4	23.5	19.4	13.6	7.6	1.5	11.6
Daily Min. Temp.	12.5	12.1	7.6	3.3	- 0.4	— 6.7	1.3
Daily Mean Temp.	18.5	17.8	13.6	8.5	3.6	- 2.6	6.5
Standard Dev., Daily Mean Temp.	1.1	0.9	1.1	1.2	1.6	2.2	0.5
Extreme Max. Temp.	33.3	34.5	31.1	27.5	21.0	15.6	34.5
Years of Record	15	15	15	15	15	15	
Extreme Min. Temp.	0.0	- 1.0	- 5.0	- 8.9	-16.1	-28.0	-30.6
Years of Record	15	15	15	15	14	15	
Rainfall	99.6	100.3	105.6	127.0	132.8	103.9	1167.6
Snowfall	0.0	0.0	0.0	2.9	13.2	53.2	260.5
Total Precip.	99.6	100.3	105.6	130.5	144.0	164.9	1436.2
Standard Dev., Total Precip.	52.5	61.1	49.3	41.4	47.0	63.6	202.6
Greatest Rainfall in 24 Hours	157.5	110.5	63.0	98.3	70.6	126.0	157.5
Years of Record	15	15	15	15	15	15	
Greatest Snowfall in 24 Hours	0.0	0.0	0.0	27.9	15.2	38.1	38.1
Years of Record	15	15	15	15	15	15	
Greatest Precip. in 24 Hours	157.5	110.5	63.0	98.3	70.6	126.0	157.5
Years of Record	15	15	15	15	15	15	
Days with Rain	9	9	9	11	12	8	105
Days with Snow	0	0	0	0	2	8	36
Days with Precip.	10	10	9	11	14	16	140

Note: Rainfall in mm, snowfall in cm, total precipitation in mm.
Temperatures in °C.
From A.E.S. Records, 1982.

The concept of degree days is often used in climate studies. A degree day is defined as "a measure of the departure of temperature for a day from some reference temperature (Canadian Climate Norm, A.E.S., Vol. 4, 1951-1980)". That is, on a day when the maximum temperature is 21°C, and the minimum 9°C, the daily mean is 15°C and the number of degree days above 10°C is therefore 5. Degree days are used by fuel companies to calculate heating needs, by foresters and agriculturalists for management purposes, and many others. For plants, a base temperature of 5°C is generally used as the start of growth. For a more detailed description see Gates (1973).

Table A-4 Comparison of Degree Days Between Kejimkujik, Kentville and Halifax for the Period 1951 - 1980, on an Annual Basis

	Kejimkujik Nat. Park	Kentville	Halifax
Degree days above 24°C	0.8	2.1	2.2
Degree days above 18°C	107.1	134.5	93.4
Degree days above 10°C	881.8	964.4	930.9
Degree days above 5°C	1750.6	1855.3	1863.3
Degree days above 0°C	2928.5	3044.4	3134.1
Degree days below 0°C	543.0	529.4	345.9

Source: Canadian Climate Normals 1951-1980, Vol. 4, A.E.S.

As Watson (1973) points out, total rainfall and snowfall at any point varies a great deal from year to year and over longer periods as well. Precipitation in two places quite close together can be affected by:

1. the elevation of the land;
2. slope; and
3. proximity of a larger water body.

In general, more precipitation will fall on the windward side of higher terrain, causing a smaller amount to fall on the leeward side. Watson (1973) suggests that the southwest shore of Kejimkujik Lake is likely to receive up to twice as much rain or snow as nearby areas.

Most of the lakes and rivers within the Park are fed by run-off, and as a result water levels fluctuate in direct proportion to the amount of rainfall, or snow melt. During the summer period, there is often no significant rainfall, or if there is the vegetation absorbs most of it. Water levels drop significantly during this time.

In contrast, rainfall in excess of 40 mm can occur within 24 hours, causing flooding conditions.

Fluctuations in water levels have important ramifications not only for outdoor recreation such as canoeing, but also for many of the rare flora and fauna. Most Coastal Plain species grow along lake or river shores, and whole stands of a species could be affected by changing water levels at crucial times. Nesting areas of turtles, loons, and ducks etc. could also be negatively affected by high water levels.

While Table A-2 shows that Kejimkujik receives 260.5 cm of snowfall yearly, a closer look at the duration of snow cover (Figures A-1 to A-5) is important when planning for winter

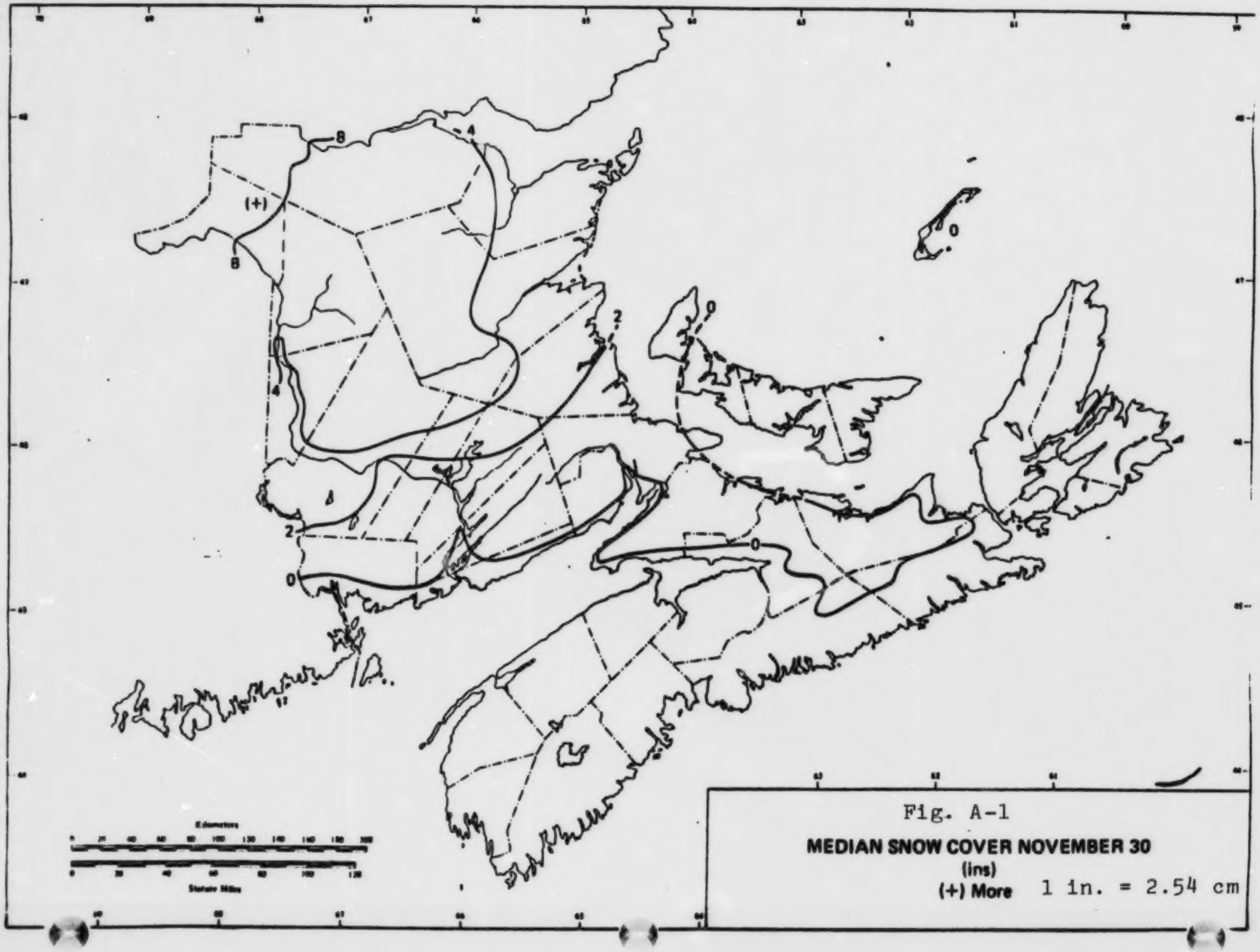
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Fig. A-1

MEDIAN SNOW COVER NOVEMBER 30

(ins)

(+) More 1 in. = 2.54 cm

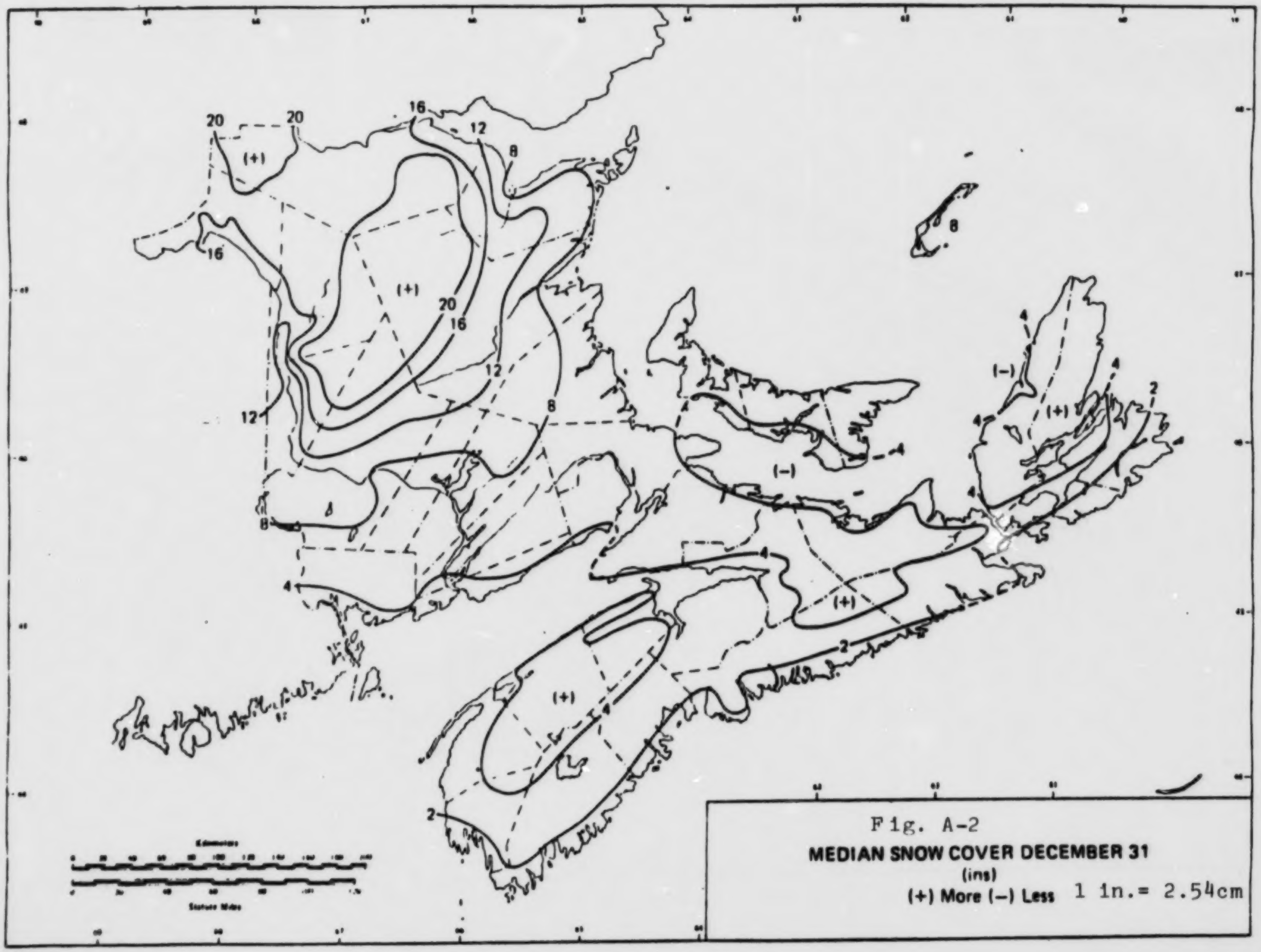
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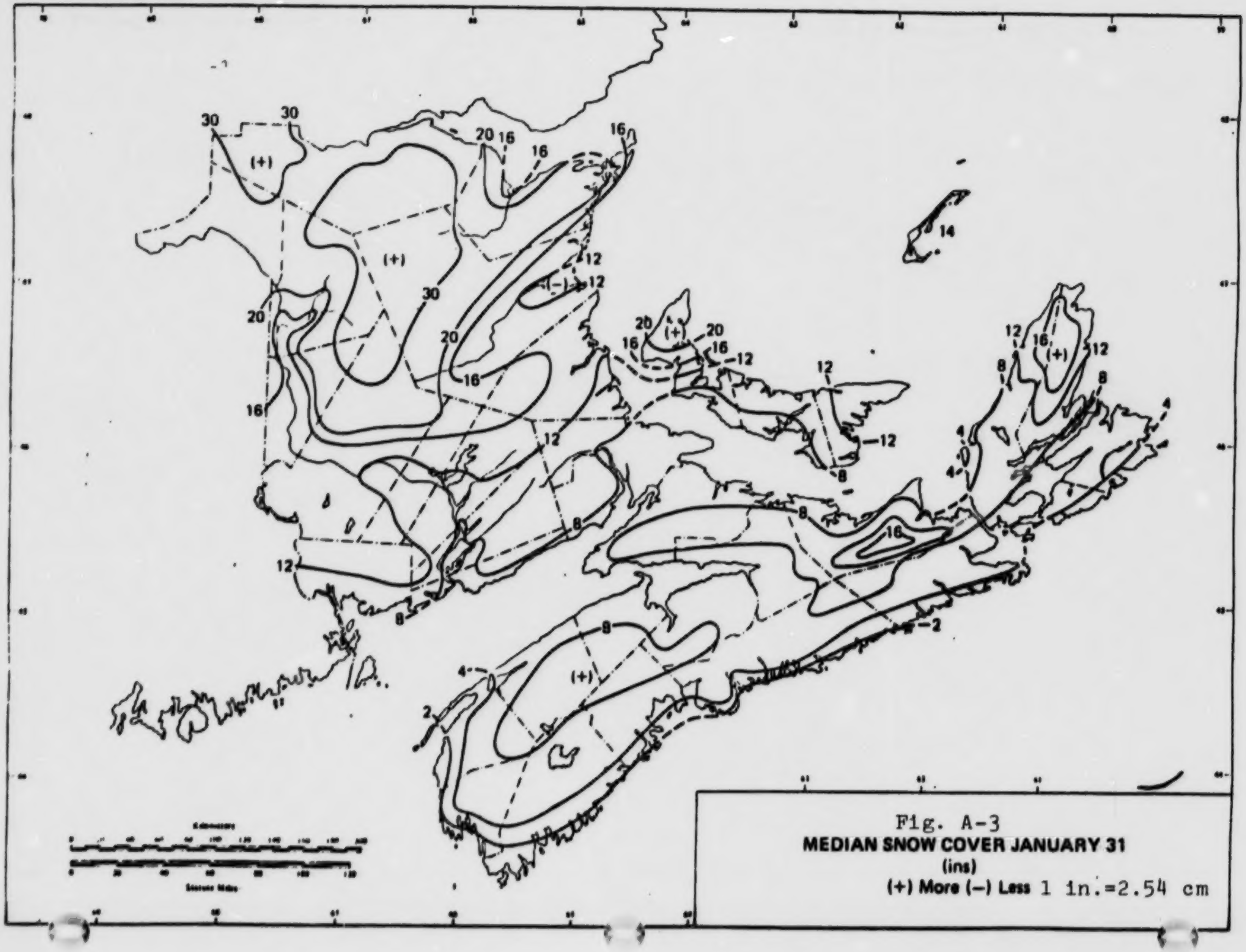
Fig. A-2
MEDIAN SNOW COVER DECEMBER 31
(ins)
(+) More (–) Less 1 in.= 2.54cm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4
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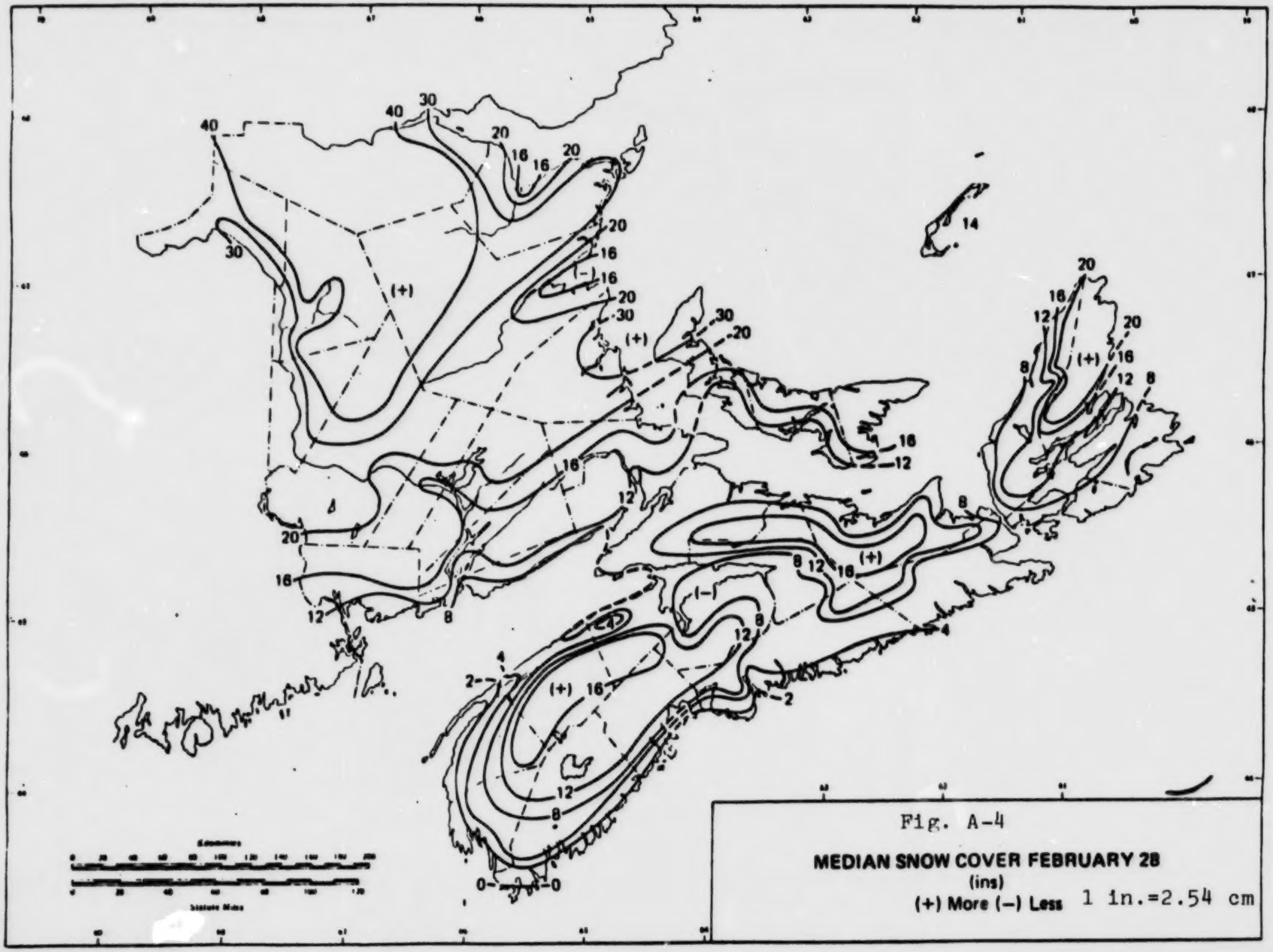
Fig. A-3
MEDIAN SNOW COVER JANUARY 31
(ins)
(+) More (–) Less 1 in.=2.54 cm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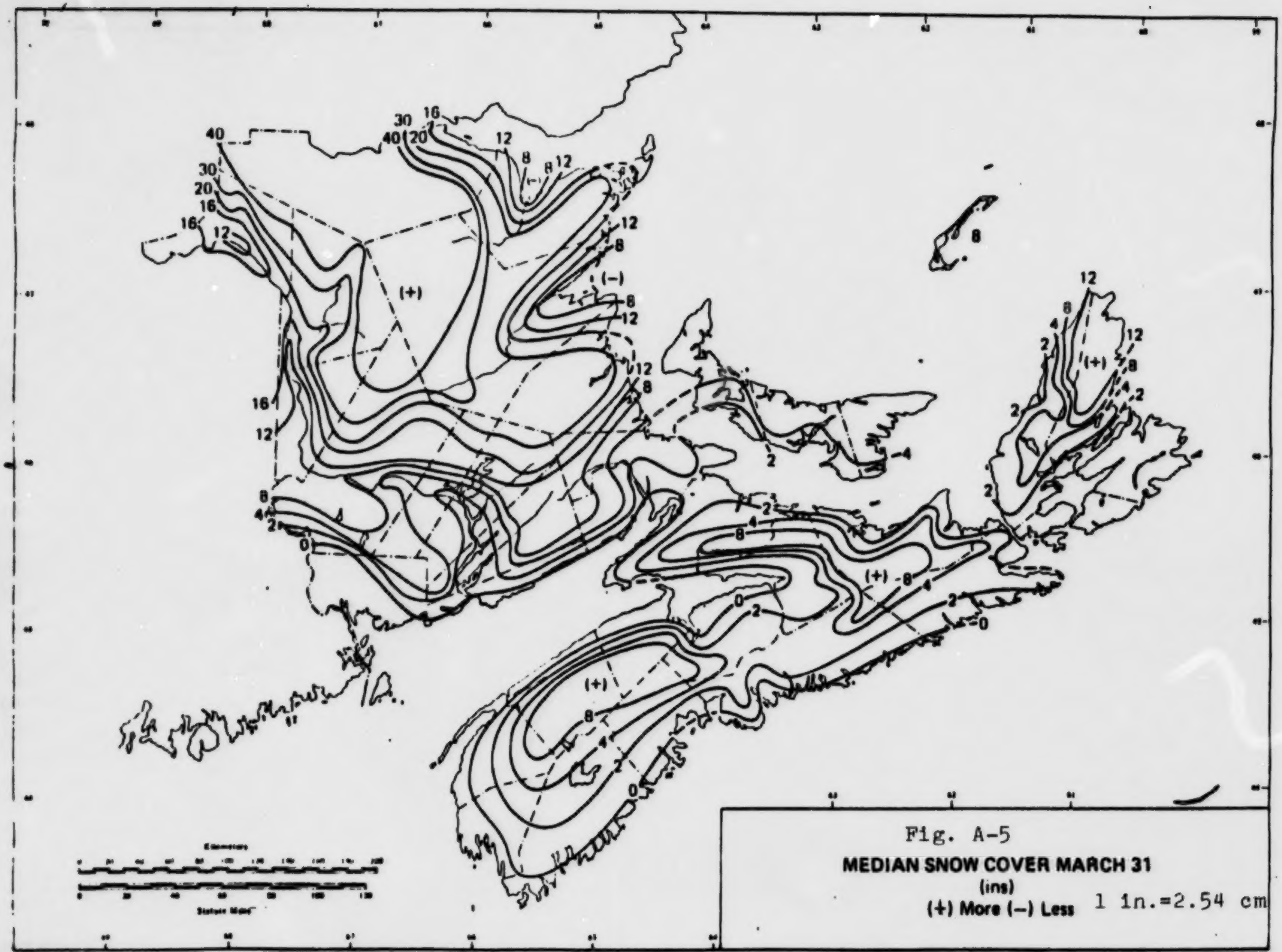
Kilometers
Statute Miles

Fig. A-4

MEDIAN SNOW COVER FEBRUARY 28
(ins)
(+) More (-) Less 1 in.=2.54 cm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2
(+)
8
Kilometers
Statute Miles

Fig. A-5

MEDIAN SNOW COVER MARCH 31

(ins)

(+) More (–) Less 1 in.=2.54 cm

recreation. Slope and exposure to sun and wind all affect the amount of snow cover. In addition, snowfall usually occurs when winds are from the east, and east-facing slopes can be expected to receive more snow.

The depth of snow and its condition is important for wildlife, especially mammals. "Open" winters when there is little or no snow cover exposes small mammals and ground vegetation to temperature extremes. The depth of snow at which deer have difficulty moving is extremely variable and depends on the compaction factor (Pers. comm., Dept. of Lands and Forests, 1983).

Although there is rarely more than 300 cm of snowfall, Watson (1973) suggests other conditions may affect deer. For example, if the snow is "rotten" the hooves of deer may sink through it, while if the snow is "fresh" it tends to compact beneath the hoof. In areas of excessive precipitation (along lakeshores) this may be an important factor, especially in spring.

Freezing rain occurs about 8 times each winter (Watson, 1973) and depending on its amount and duration can have severe effects on flora and fauna.

Precipitation Chemistry

Normal rain or snow is seldom completely "clean" or "pure" in the chemical sense. Chemicals within precipitation can include those given off by forest fires, or volcanoes, or even dust picked up by blowing winds adhering to rain drops. At Kejimkujik, two of the most common ions to be found in the rainfall are chloride ions (mean value 61.5%) and sodium ions (mean value 55.9%) (Kerekes, 1973). At Kejimkujik the nature of the bedrock of granite and quartzite means that there will be few minerals in the surface waters. Kerekes (pers. comm., 1984) suggests, therefore, that precipitation is the major source of some essential nutrients such as phosphorous within the Park. Levels of phosphorous and calcium in precipitation are very low, but in this area may be very significant in terms of available nutrients in aquatic ecosystems, and in soil chemical reactions.

Normal rainfall is slightly acidic due to absorption of small amounts of natural atmospheric carbon dioxide which, when dissolved in water, forms a weak acid, carbonic acid. The pH of "normal" precipitation in eastern North America is about 5.6. However, "acid rain" in this area is frequently many times more acidic than normal rain (often well below pH 4) because of sulphur and nitrogen compounds from industrial sources and automobiles. The pH values of precipitation are not uniform throughout the year, and tend to fluctuate depending on storm origin, rainfall duration and pollution loading.

The effects of such extremely acidic precipitation are being monitored and studied.

Visibility:

Visibility is a measure of sunshine, fog, snow and/or drizzle. Data on visibility is scarce for inland portions of Nova Scotia. Coastal locations report visibility but these data cannot be applied to the Park. Fog is certainly not as frequent at Kejimkujik.

A phenomenon locally termed "heat haze" occurs over large lakes, such as Kejimkujik, and can reduce visibility from the fire tower on extremely hot, humid summer days.

Wind:

In general, summer winds at Kejimkujik will be from the southwest quadrant, and from the northwest in other seasons. Winds accompanying storms often occur from the northeast. Colder months tend to have stronger winds than warm months: the lightest winds occur in July (Resource Atlas, 1973). The wind data from Yarmouth are consistent with wind direction and speed at Kejimkujik (Watson, 1973). A summary of these data is presented in Table A-5. Winds from the west and northwest are more frequent during the colder months, as cold central Canadian Arctic air masses move toward eastern Canada. Warmer tropical air predominates in summer bringing winds from the south and southeast (Resource Atlas, 1973).

Often the wind is stronger during the afternoon than at any other time of the day. Throughout the province windspeeds are from 20 to 50 percent higher during that time than the monthly means, especially from April through to August (Watson, 1973).

Watson goes on to point out that a lake breeze dependent upon the difference in the temperature of the air over the land and over the water will blow from the water to the land, particularly during warm sunny spring and summer afternoons. The winds over the eastern half of Kejimkujik and Peskowesk Lakes, and possibly other lakes where conditions are right, cause a safety problem to boaters particularly during the afternoon. On Kejimkujik Lake large waves build up from about 11 a.m. as the wind begins to rise.

Table A-5 Percentage Frequency of Wind Direction

Yarmouth A N.S. Period 1955-1980

Lat. 43°50'N Long. 066°05'W Elevation 43 m Altitude

Percentage Frequency	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
N	10.8	8.9	9.0	6.4	4.1	3.2	2.1	2.8	6.3	7.5	8.6	8.9	6.6
NNE	4.7	4.1	4.3	3.5	2.1	1.8	0.7	1.2	2.8	3.2	5.0	4.0	3.1
NE	3.8	3.6	4.1	3.8	2.1	1.5	0.9	1.8	2.9	3.4	4.6	3.9	3.0
ENE	4.7	3.9	3.8	2.9	2.4	2.0	1.0	1.9	2.9	3.8	4.5	5.2	3.2
E	7.4	6.4	6.7	6.1	6.4	4.3	2.6	3.3	4.9	5.5	6.7	8.4	5.7
ESE	3.1	3.6	3.8	3.8	3.4	2.9	2.0	1.9	2.8	3.0	4.1	3.7	3.2
SE	2.7	3.1	3.4	3.6	4.2	4.0	3.8	3.4	2.9	3.3	3.5	2.9	3.4
SSE	2.4	2.6	3.2	4.1	4.7	6.2	6.8	5.1	4.0	4.0	3.1	2.8	4.1
S	4.0	4.7	5.7	7.8	11.3	15.0	16.3	12.1	9.4	8.5	6.4	4.5	8.8
SSW	2.6	2.5	3.2	4.2	5.8	8.1	8.5	7.8	6.9	4.9	4.1	3.0	5.1
SW	3.6	4.0	3.3	5.2	7.8	9.6	10.3	10.2	8.3	6.3	4.3	3.9	6.4
WSW	4.0	3.9	4.0	6.2	8.4	10.1	9.3	9.0	6.8	6.1	4.5	4.2	6.4
W	7.6	8.7	10.0	11.8	12.4	11.8	13.3	13.1	10.9	10.3	8.7	7.0	10.5
WNW	9.9	9.7	9.5	8.9	6.7	5.2	5.8	6.5	6.8	7.3	8.6	8.4	7.8
NW	14.5	14.6	12.5	10.2	7.9	4.8	5.6	7.9	9.4	9.5	10.5	14.5	10.2
NNW	10.3	10.7	9.1	7.3	5.2	3.3	2.8	3.7	5.6	7.3	7.6	10.0	6.9
Calm	3.9	5.0	4.4	4.2	5.1	6.2	8.2	8.3	6.4	6.1	5.2	4.7	5.6

Table A-5 (cont.) (Mean Wind Speed in Kilometres per Hour)

Yarmouth A. N.S. Period 1955-1980

Lat $43^{\circ}50'$N Long. $066^{\circ}05'$W Elevation 43 m Altitude

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
N	20.0	18.4	19.7	17.9	17.9	16.0	13.3	13.2	14.4	17.3	17.7	18.7	17.0
NNE	17.3	17.8	19.1	18.8	17.6	15.7	12.8	12.9	14.4	15.4	16.6	15.7	16.2
NE	15.1	17.3	17.2	18.3	16.1	15.1	11.3	12.7	12.5	14.3	15.0	14.5	15.0
ENE	18.2	18.1	20.7	19.5	19.0	17.0	12.2	14.2	14.2	14.4	16.0	16.6	16.7
E	20.0	21.9	21.2	21.9	18.6	17.0	13.0	13.4	13.9	16.1	16.6	17.6	17.6
ESE	18.3	20.8	22.9	20.0	17.4	16.4	12.6	15.1	15.9	18.6	18.6	19.9	18.0
SE	17.8	19.5	21.2	19.7	17.5	15.7	12.9	13.9	16.0	18.5	19.6	20.4	17.7
SSE	20.7	21.7	21.0	20.2	17.6	15.1	13.5	12.8	16.7	17.3	19.7	23.0	18.3
S	22.9	21.5	22.2	20.7	18.9	16.6	15.9	15.4	18.4	18.6	22.4	22.9	19.7
SSW	24.4	22.4	22.4	20.2	20.4	18.9	18.6	19.0	19.0	18.9	21.4	23.5	20.8
SW	22.0	21.8	20.1	18.8	18.3	18.2	17.5	17.4	17.7	17.2	21.0	22.7	19.4
WSW	21.9	21.7	19.8	18.1	18.3	16.9	15.3	14.9	15.5	17.1	20.7	23.5	18.6
W	24.5	23.0	22.2	19.2	16.5	15.1	13.3	13.8	14.5	18.9	22.0	15.7	19.1
WNW	27.3	24.8	25.2	20.8	17.5	15.3	14.4	14.6	15.9	20.4	24.1	27.0	20.6
NW	25.3	23.1	23.7	20.4	18.3	15.0	14.7	15.1	16.0	19.7	23.0	25.7	20.0
NNW	23.6	22.4	23.1	20.1	18.9	15.1	14.2	15.0	16.6	19.6	20.8	23.1	19.4

Table A-5 (cont.)

Yarmouth A N.S.   Period 1955-1980

Lat. 43°50'N Long. 066°05'W Elevation 43 m Altitude

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Year
All Directions (km/hr)													
	21.3	20.5	20.9	18.9	17.2	15.4	13.8	13.8	15.0	16.9	19.1	20.9	17.8
Maximum Hourly Speed (km/hr)													
	89	108	77	85	80	58	56	56	80	97	74	76	108
	S	S	ENE	E	E	NNE	SSE	NNW	SSE	SE	WNW	WNW	S
Maximum Gust Speed (km/hr)													
	134	163	137	121	113	93	85	80	132	137	116	122	163
	S	SW	W	E	E	N	E	SSW	SSE	SVL	WSW	NNW	SW

Height of Anemometer 10.1 m

Station Information: This station is on the runway complex south of Runway 24. There are no obstructions. The surrounding terrain is relatively flat in all directions.

Other Climatic Features:

Humidity is of importance during the months of highest visitor use of the Park. Watson (1973) gives details about how "Humidex" values are calculated and indicates that humidex values of 85 and above will cause varying amounts of discomfort in people. From Table A-6 it can be seen that this should be a major factor in planning for outdoor recreation of any kind. Exposed lakeshores provide some relief for this factor due to the prevailing winds.

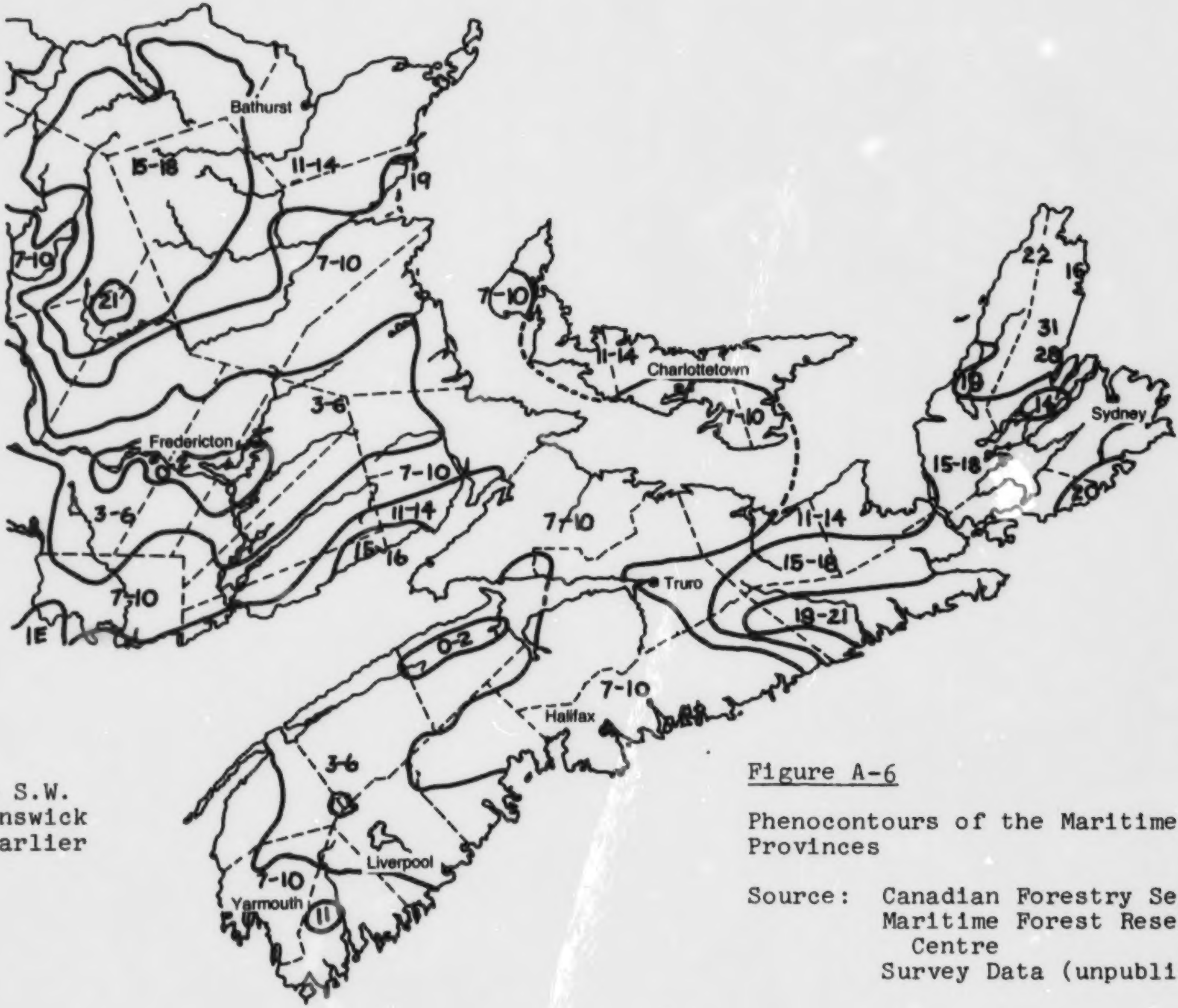
Watson gives more detailed accounts of fog, thunderstorms, maximum and minimum precipitation and other criteria for planning and management of Park recreation programs.

Table A-6 Percent of Days with Humidex of 85 or More, Kejimkujik National Park

June	July	August	September
17%	23%	19%	17%
(last ten days only)			(first ten days only)

Phenological Factors:

No new data is available for phenological forecasts and the following is excerpted from the 1973 Resource Atlas, using Canadian Forestry data.


Bathurst
15-18
11-14
19
7-10
21
7-10
Fredericton
3-6
3-6
7-10
11-14
15
16
7-10
1E
7-10
11-14
Charlottetown
7-10
7-10
0-2
Truro
11-14
15-18
19-21
7-10
Halifax
3-6
Liverpool
7-10
Yarmouth
11
22
16
31
28
19
14
Sydney
15-18
20

extreme S.W.
New Brunswick
1 day earlier

Figure A-6

Phenocontours of the Maritime Provinces

Source: Canadian Forestry Service
Maritime Forest Research Centre
Survey Data (unpublished)

Figure A-6 shows phenocontours for the Maritime Provinces which delineate regions which have similar times of initiation of tree growth using Fredericton, New Brunswick as day 0. Although only a general instrument, phenocontours give valuable information for determination of the behavioural and developmental patterns for insect life and are commonly used by forest entomologists. Kejimkujik National Park falls in a region where spring tree growth begins three to six days later than at Fredericton and Kentville.

Paleoclimate:

The only reference noted that discusses changes in the climate at Kejimkujik is found in a 1982 pollen/diatom core sampling study (Delorme, 1982). This author suggests possible period of drought sometime in the last 1000 years, but assigns no dates to this period.

Microclimate:

No significant data on microclimate is available for Kejimkujik. However, Watson (1973) states that there is a slight variation in annual mean temperature throughout the Park; the area southeast of the Mersey River drainage area being slightly warmer than the extreme western area. Presumably, the difference in elevation and topography of the two areas would also result in differences in wind, and precipitation as well.

Evaluation:

Management Objectives:

1. To monitor elements of the climate of the Kejimkujik National Park area for the purposes of forest fire hazard determination, public safety and scientific research.

2. To analyze climatic trends to determine short and long term impacts on natural resource values and public use of Park facilities.

Unique, Critical and Representative Areas:

The data suggests that the Park lies within a climatic pocket which may influence the survival of certain rare flora and fauna, including the Coastal Plain plant species, and the Blanding's Turtle.

Resource Management Concerns:

1. Research in Kejimkujik National Park by the LRTAP study group has indicated that the problem of environmental acidification, primarily caused by acid rain, is a major concern. Data from European studies, and from the LRTAP programme, indicate near catastrophic changes may occur (or indeed are occurring) as a result of the sulphate loading in precipitation. Parks will encourage further research and strive to reduce the effects of acid rain.

2. Research into potential climate changes caused by phenomena such as the "Greenhouse Effect" (Strahler, 1975) have raised some concern in the academic community. Park resource managers should keep abreast with this topic, as research continues.

Study Requirements:

1. Complete and accurate data on weather conditions is an important basic requirement for quality natural resources research. As such, monitoring should continue in Kejimkujik with provision made for computerization of data, to facilitate storage and analysis.

2. Research should continue on the subject of long-range transport of air pollutants, and its impact on the environment.

Opportunities:

Virtually all aspects of the natural and human history of the Park can be related to climate. Climate, therefore, can be utilized as a general theme in interpreting many Park processes and environmental phenomena. Particularly notable is the microclimatic influence on certain plants and reptile distribution. Kejimkujik National Park's role in acid rain research also provides material for interpretation to the public, and for autecological study.

Limitations:

Public use of the Park and its facilities will obviously be affected by the climate at a given time.

Interpretive activities should be timed in accordance with the weather, where possible. For example, guided walks should be given at times or locations where extreme conditions of heat and humidity do not interfere with comfort. Guided canoe paddles must be cancelled if high winds, or other climatic conditions, prevail.

Visitors to the Park who wish to participate in canoeing and cross-country skiing should be informed about the danger of winds and hypothermia. General weather conditions in winter should be available on a daily basis for Park users.

Climatic conditions at Kejimkujik can be described as extremely variable during all seasons of the year. Up-to-date weather projections should be available to visitors to ensure optimal safety for wilderness-oriented recreational activities.

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WATER

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Description:

Approximately one-third of Kejimkujik National Park consists of fresh water. This resource is one of the major features of the Park historically and presently. The surface waters consist of forty-six lakes and ponds and more than thirty streams and rivers. In general, the Park's waters are oligotrophic, many of them are naturally acidic, and derive largely from run-off from the surrounding landscape.

Drainage Basins:

There are two major drainage systems receiving water from the Park area, both of which empty into Lake Rossignol. The Shelburne River system involves five small lakes, and drains only about two percent of the total volume in the Park. The Mersey River system includes the remaining forty lakes, eight stream basins and an area of 364 km^2 of the Park (Fig. B-1).

Most of the lakes are maintained by surface flow. The relationship between ground water and surface water is not fully defined at present. Research carried out on ground water influence at Beaverskin Lake indicates that this relationship may be very complex (Jacques, Whitford and Assoc., 1983).

Most of the watersheds of the Park's lakes are small, relative to the lake surface area. The ratio of watershed drainage area to lake surface area is a useful

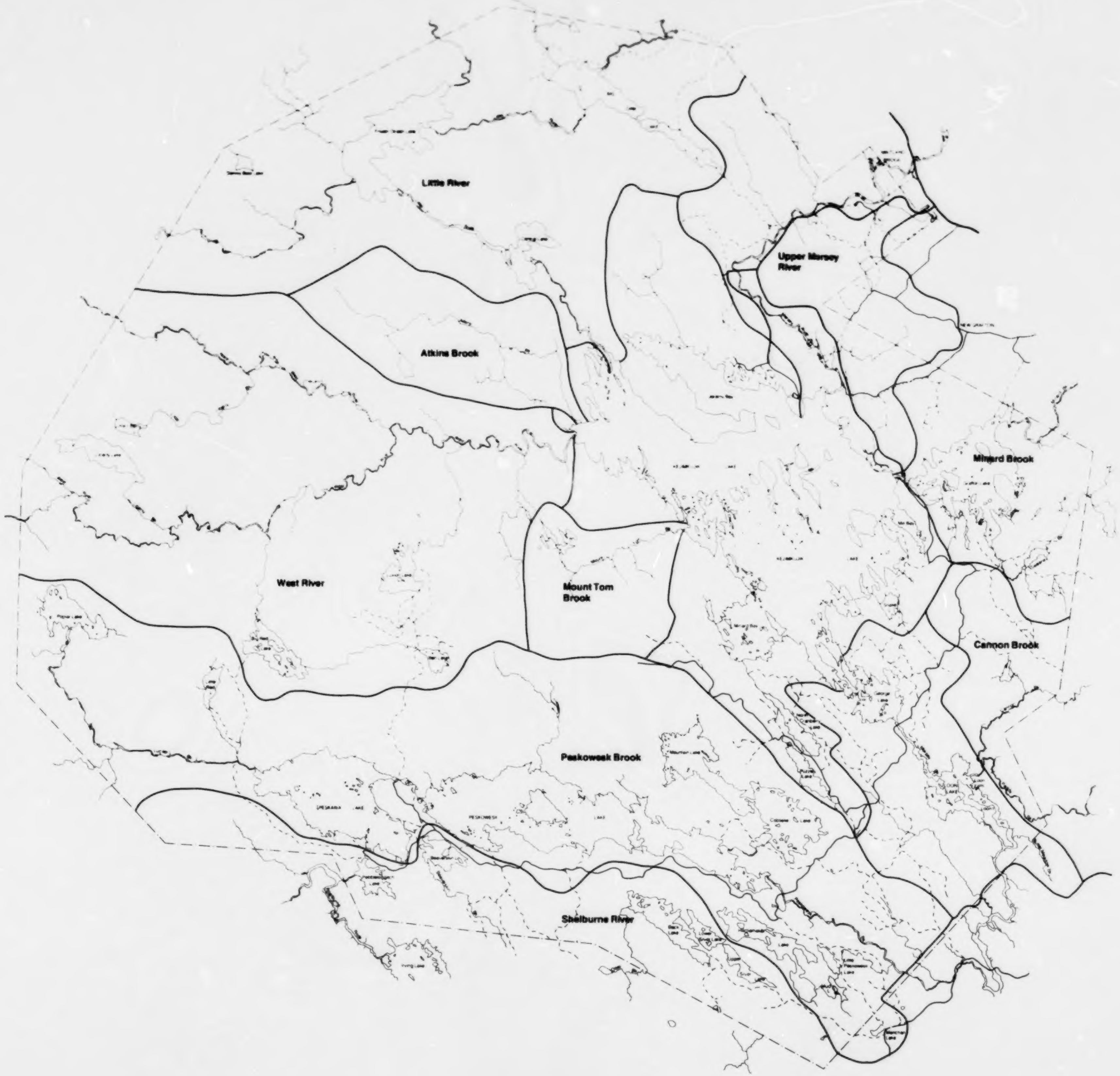

Little River
Upper Mersey River
Atkins Brook
Minard Brook
West River
Mount Tom Brook
Cannon Brook
Peskowesk Brook
Shelburne River

Figure B-1

Major Stream Drainage Basins

Base Map compiled by Forest Management Institute, 1973

Redrafted by Eastern Ecological Research Ltd., 1975

Kejimkujik National Park

Parks Canada Atlantic Region

Miles 1 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

Yards 1000 0 1000 2000 3000 4000 1:100,000

N

measurement because it relates to the degree of nutrient loading that a lake receives. At Kejimkujik in general, lakes with small drainage areas tend to be clear because their source of water does not have a chance to pass through bogs, and does not pick up the dark peaty debris. Highly coloured lakes receive water from a larger drainage area; these waters pass through bogs, picking up organic acids and tannins.

Lakes:

The lakes vary considerably in size, some being as small as 0.5 hectares, and the largest, Kejimkujik, being 2,434 hectares (Kerekes and Schwinghamer, 1973a).

The ratio between the length of the shoreline and the area of the lake (shoreline development indices) is low in most lakes, indicating that the perimeter of the lake is relatively smoothly curved. In some of the larger lakes (i.e. Grafton, Hilchemakaar, Kejimkujik, Peskowesk) shoreline indices are high, indicating that there are many points, bays and inlets.

All the lakes in the Park are relatively shallow. Mean depths are generally less than four metres except in Kejimkujik (4.4 m) and Mountain (4.3 m). Maximum depths are variable, from 19.2 metres in Kejimkujik to 2 metres in Red Lake.

The flushing rate, that is, the number of times the volume of the lake is replaced in a year, is an important feature of lakes in this region. In general, lakes with high flushing rates tend to be less productive than

. . . text continued p. B-18

Table B-1 Inventory of Streams Draining Through Kejimkujik National Park, Nova Scotia, Arranged According to a Hierarchical Catalogue (Kerekes and Schwinghamer, 1971)

Each drainage area is defined by area and elevation. Stream morphometry includes:

TL	- Channel Length
D	- Distance Source to Mouth
R	- Rise
G	- Gradient as R/D
TL(km)/D(km)	- Index of Length

For streams which cross Park boundary, data are given both for total drainage and for drainage within Park in the second line of couplet.

Drainage Catalogue Reference: J. Kerekes and P. Schwinghamer, 1971, Canadian Wildlife Service Manuscript Report.

Table B-1 Inventory of Streams Draining Through Kejimkujik National Park

Drainage Cat.Ref.	Name	Drainage Area		Stream Characteristics				
		Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
01	Mersey River	842.0 362.0	260 - 90 200 - 90	147.4 24.4	42.3 15.3	170 32	4.0 2.0	3.50 1.60
01.01	Peskowesk Brook	98.0 78.0	170 - 135 155 - 135	6.38 4.13	4.0 3.1	30 15	8.5 4.9	1.60 1.18
01.01.01	Red Brook	0.75 0.50	110 - 90 110 - 90	1.25 0.3	1.2 0.2	10 3	12.7 1.5	1.04 1.50
01.01.02	Red Brook	7.70 6.30	140 - 105 140 - 105	3.25 3.25	1.4 1.4	17 17	12.1 12.1	2.31 2.31
01.01.02.b.01	"Menchan Brook"	2.0 0.8	120 - 110 120 - 110	1.0 0.8	0.8 0.6	4 3	5.0 5.0	1.20 1.33
01.01.03		1.6	120 - 110	0.88	0.7	7	10.0	1.25
01.01.a.04		5.2	200 - 110	5.63	2.3	75	32.5	2.01
01.01.a.05	"Cobrielle Brook"	11.9	170 - 110	0.75	0.5	30	60.0	1.50
01.01.b.06	Lucifer	35.0 17.0	200 - 120 185 - 120	7.0 7.0	4.5 4.5	70 50	15.5 11.1	1.56 1.56
01.01.b.06.01	"Little Red Brook"	4.8	185 - 120	1.64	1.8	60	33.3	1.17

Table B-1 (cont.) Inventory of Streams Draining Through Kejimkujik National Park

Drainage Cat.Ref.	Name	Drainage Area		Stream Characteristics				
		Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
01.01.b.06.02		10.3	200 - 140	5.50	4.0	30	7.5	1.38
		1.2	170 - 140	1.25	0.8	10	12.5	1.25
01.01.b.06.02.01		2.7	170 - 140	4.50	3.8	20	5.3	1.20
		0.9	155 - 140	0.50	0.40	5	12.5	1.25
01.01.b.06.03		7.2	200 - 170	4.0	2.0	15	7.5	2.00
		2.5	175 - 170	2.5	1.3	4	3.2	2.00
01.02	Square Camp Brook	4.6	125 - 90	3.75	3.3	20	6.2	1.07
01.03	Butler Meadow Brook	1.5	110 - 90	2.25	1.4	8	5.5	1.60
		0.3	100 - 90	0.87	0.4	4	10.0	2.10
01.a.04	Cannon Brook	33.0	170 - 90	4.63	3.5	35	10.0	1.33
		8.5	140 - 90	3.38	2.5	20	8.0	1.38
01.a.04.01	Paddy Brook	15.3	170 - 90	5.50	2.8	40	14.0	2.00
		1.6	110 - 90	3.00	1.8	10	5.7	1.72
01.a.04.02		4.6	140 - 90	1.1	0.9	20	22.2	1.16
01.c.05	"North Cranberry Brook"	4.6	120 - 90	1.13	0.9	12	13.3	1.26
01.c.(06).a		An assumed stream (see text for explanation)						

Table B-1 (cont.) Inventory of Streams Draining Through Kejimkujik National Park

Drainage Cat.Ref.	Name	Drainage Area		Stream Characteristics				
		Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
01.c.07	Mount Tom Brook	10.2	200 - 90	3.75	2.8	60	21.5	1.34
01.c.07.01		1.2	170 - 90	1.00	0.8	12	15.0	1.25
01.c.07.02		1.5	170 - 110	0.88	0.8	10	12.5	1.1
01.c.08	West River	120.0 76.0	215 - 90 200 - 90	26.0 21.6	20.8 8.5	40 35	2.0 4.1	1.3 2.6
01.c.08.01		0.4	125 - 90	0.3	0.3	2	1.5	1.0
01.c.08.02		5.8	200 - 90	1.75	1.4	10	7.1	1.25
01.c.08.02.01		1.0	140 - 120	1.50	1.1	5	4.5	1.36
01.c.08.03	Luxion Brook	8.0	185 - 90	4.13	2.60	50	19.3	1.59
01.c.08.04		0.5	110 - 90	0.75	0.6	10	16.7	1.25
01.c.08.05	North West River	36.0 20.0	215 - 105 170 - 105	12.5 8.25	10.5 6.5	70 30	6.7 10.0	1.19 1.27
01.c.08.05.01	Little Liberty Brook	5.8	155 - 150	4.0	2.5	8	3.2	1.38

Table B-1 (cont.) Inventory of Streams Draining Through Kejimkujik National Park

Drainage Cat.Ref.	Name	Drainage Area		Stream Characteristics				
		Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
01.c.08.06	"Big Red Brook"	10.7	185 - 120	4.63	3.50	35	10.0	1.33
01.c.08.07	Liberty Brook	3.4	170 - 140	2.0	1.25	6	4.8	1.60
01.c.08.08		3.9	200 - 140	2.38	1.5	20	13.6	1.59
01.c.08.09		1.6	185 - 140	1.40	1.0	10	10.0	1.40
01.c.09		0.1	195 - 90	0.23	0.2	3	1.5	1.15
01.c.10	Atkins Brook	13.6	140 - 90	8.75	5.5	20	3.7	1.59
01.c.10.01		1.2	110 - 90	0.38	0.3	5	16.7	1.26
01.c.10.02		1.9	110 - 90	2.00	1.6	5	3.1	1.25
01.c.11	Little River	131.0 56.0	215 - 90 170 - 90	28.25 17.25	11.0 7.4	55 30	5.0 10.0	2.60 2.34
01.c.11.b.01	Inness Brook	30.0	215 - 110	10.50	7.8	55	7.1	1.35
01.c.11.b.02	Stewart Brook	11.0 2.0	185 - 110 170 - 110	6.50 2.50	3.5 1.4	50 20	14.4 14.3	1.86 1.78

Table B-1 (cont.) Inventory of Streams Draining Through Kejimkujik National Park

		Drainage Area		Stream Characteristics				
Drainage Cat.Ref.	Name	Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
01.c.11.b.03	Lewis Brook	20.0 1.6	215 - 110 170 - 110	7.00 2.25	5.8 1.3	65 8	11.3 6.2	1.25 1.75
01.c.11.c.04		5.6 1.8	200 - 125 170 - 125	3.00 1.80	2.2 1.2	25 10	12.8 8.3	1.36 1.50
01.c.12		5.3	125 - 90	1.25	1.1	5	4.5	1.14
01.c.13		1.3	110 - 90	0.23	0.2	2	10.0	1.15
01.c.14	Minard Brook	53.0 18.0	170 - 90 155 - 90	9.00 1.75	3.0 1.0	8 2	2.7 2.0	3.00 1.75
01.c.14.a.02	Sweeney Brook	12.0 4.7	170 - 110 140 - 110	5.75 4.25	4.0 3.6	6 4	1.5 1.1	1.44 1.18
01.c.14.a.01.01	"McGinty Brook"	2.0	140 - 110	1.75	0.8	5	6.3	2.19
01.c.14.a.02.02	(not in Park)	2.4	140 - 110	3.00	1.8	2	1.1	1.67
01.c.14.a.(03)		An assumed stream (see text for explanation)						
01.c.14.04		0.8	140 - 100	0.25	0.2	2	10.0	1.25
01.c.14.05	Fraser Brook	0.5	140 - 110	0.50	0.4	2	5.0	1.25

Table B-1 (cont.) Inventory of Streams Draining Through Kejimkujik National Park

Drainage Cat.Ref.	Name	Drainage Area		Stream Characteristics				
		Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
01.c.15		1.2	110 - 90	0.13	0.1	1	10.0	1.25
01.c.15.a.01	"Snake Brook"	0.4	110 - 90	0.25	0.2	1	5.0	1.25
01.c.16		1.2	110 - 90	0.30	0.2	1	5.0	1.50
01.17	"Joe's Brook"	3.9	155 - 90	0.63	0.3	2	6.7	2.10
01.18		0.4	140 - 90	0.25	0.2	2	10.0	1.25
01.19		2.2	120 - 105	0.75	0.4	3	7.5	1.88
01.20		3.3	140 - 110	3.38	3.0	2	6.7	1.13
01.21		5.8	170 - 110	3.25	2.5	15	6.0	1.30
01.22.01		1.3	140 - 110	0.38	0.2	5	25.0	1.90
02	Shelburne River	19.0	170 - 110	0.00	(not in Park)			
02.01	Otter Brook	9.3 9.3	125 - 110 125 - 110	4.38 2.40	2.9 1.8	12 5	4.3 2.8	1.53 1.33

Table B-1 (cont.) Inventory of Streams Draining Through Kejimkujik National Park

		Drainage Area		Stream Characteristics				
Drainage Cat.Ref.	Name	Area km^2	Elevation m	TL km	D km	R m	G m/km	IL
02.02	Beaverskin Brook	4.8	140 - 110	4.75	3.5	20	5.7	1.30
		4.8	140 - 110	3.37	2.2	15	6.8	1.53
02.03	"Pebble-loggitch Brook"	2.0	140 - 120	0.30	0.3	3	10.0	1.00
02.04	"Granite Brook"	2.9	170 - 125	1.80	1.5	5	3.3	1.20
		2.9	170 - 125	0.25	0.2	2	10.0	1.25

Table B-2 Morphometric Characteristics of 45 Lakes in Kejimkujik National Park, Arranged Alphabetically (Kerekes and Schwinghamer, 1973)

Data include:

E - Geodetic Elevation

ML - Maximum Length

L - Shoreline Length

A - Basin Area

IA - Island Area

Is - Number of Islands

zm - Maximum Depth

A' - Drainage Area

Table B-2 (cont.) Morphometric Characteristics of 45 Lakes in Kejimkujik National Park

Lake	E m	ML km	L km	A ha	Ia ha	Is	zm m	A' ha
Back	100	2.3	8.6	78.4	1.5	7	5.75	410
Beaverskin	120	1.1	5.4	39.5	2.3	2	6.25	100
Ben	170	0.7	2.6	20.4	-	-	2.00	170
Big Dam (East)	120	1.9	5.0	45.5	0.1	1	4.20	200
Big Dam (West)	120	2.2	6.1	105.0	0.3	1	9.50	4000
Big Red	160	1.7	9.1	70.5	7.4	9	2.20	800
Central	100	1.3	6.1	68.4	-	-	1.80	12800
Coblielle	120	2.0	12.7	132.0	4.2	13	6.25	1150
Dennis Boot	135	0.5	1.5	8.7	-	-	-	55
Frozen Ocean	105	2.9	12.7	228.0	0.2	1	7.60	11600
George	90	1.7	8.8	77.8	3.5	13	8.50	68700
Grafton	100	2.6	34.7	270.0	51.1	49	10.00	5300
High	90	0.4	1.2	3.8	-	-	2.75	110
Hilchemakaar	105	2.3	12.4	95.4	2.0	2	7.25	380
Kejimkujik	90	9.7	95.4	2435.0	197.0	120	19.20	68200
Liberty	135	1.8	6.0	73.3	0.1	1	-	200
Little Liberty	135	0.7	2.1	15.4	-	-	-	100
Little Peskowesk	100	0.8	1.8	11.3	-	-	4.00	630
Little Red	150	0.9	2.7	19.6	-	-	1.30	380
Loon	85	1.5	9.6	73.8	2.7	7	8.50	72600
Lower Silver	105	1.0	3.7	24.7	0.8	2	5.25	160
Luxion	135	1.1	6.1	47.1	1.0	2	8.50	470
McGinty	105	0.4	1.0	4.4	-			
Mountain	120	2.6	13.7	136.0	0.6	4	14.25	820
Mud	100	0.6	1.9	7.0	0.1	1	2.20	610

Table B-2 (cont.) Morphometric Characteristics of 45 Lakes in Kejimkujik National Park

Lake	E m	ML km	L km	A ha	Ia ha	Is	zm m	A' ha
North Cranberry	105	1.8	4.9	34.3	0.1	2	5.00	360
Pebbleloggitch	120	1.2	4.4	33.4	-	-	2.50	160
Peskawa	120	3.8	18.2	388.0	0.7	14	9.00	6600
Peskowesk	105	7.1	29.1	685.0	26.0	7	13.00	8500
Poplar	170	1.6	7.5	82.5	1.5	6	-	560
Puzzle	120	1.6	4.6	33.7	0.03	1	6.10	210
Snake	90	0.6	1.7	12.7	-	-	2.50	110
Upper Silver	115	1.1	3.5	24.3	-	-	5.75	90
Lake # 1	135	0.2	0.7	2.8	-	-	-	23
Lake # 7	105	0.6	3.0	9.8	-	-	-	70
Lake # 12	120	0.3	0.6	1.3	-	-	-	10
Lake # 13	120	0.1	0.2	0.3	- -	-	-	20
Lake # 14	120	0.3	0.7	1.4	-	-	-	20
Lake # 15	115	0.8	4.2	14.0	0.1	3	-	60
Little Kempton Lake	100	0.3	1.2	2.5	-	-	2.50	80
Lake # 17	100	0.2	0.4	0.9	-	-	-	30
Lake # 24	105	0.2	0.4	1.2	-	-	-	160
Lake # 27	90	0.1	0.3	0.5	-	-	-	10
Lake # 28	90	0.5	1.4	6.3	-	-	-	410
Lake # 46	115	0.2	0.4	0.5	-	-	-	30

Table B-3 Morphologic Indices of 45 Lakes in Kejimkujik National Park, Nova Scotia, Arranged Alphabetically (Kerekes and Schwinghamer, 1973)

Indices include:

V - Basin Volume

$\bar{z}$ - Mean Depth

A':A - Drainage Ratio

WR - Water Renewal

D_L - Shoreline Development

I - Insulosity

P - Pollution Hazard

Table B-3 (cont.) Morphologic Indices of 45 Lakes in Kejimkujik National Park

Lake	V m^3 x 1000	$\bar{z}$ m	A':A	WR	D_L	I (%)	P (%)
Back	1706	2.2	5.2	2.1	3.1	-	-
Beaverskin	864	2.2	2.5	1.0	2.4	5.5	-
Ben	252	1.2	8.3	5.7	1.7	-	-
Big Dam (East)	1055	2.3	4.4	1.6	2.1	0.1	-
Big Dam (West)	2593	2.5	38.1	13.1	1.7	-	72
Big Red	704	1.0	11.4	9.4	3.0	9.5	-
Central	825	1.2	187.1	131.0	2.1	-	59
Coblielle	2595	2.0	8.7	3.8	3.1	3.0	-
Dennis Boot	--	-	6.3	-	1.4	-	-
Frozen Ocean	4241	1.9	50.9	23.2	2.4	0.1	64
George	1825	2.4	883.0	319.6	2.8	4.3	62
Grafton	7440	2.8	19.6	6.1	6.0	15.9	68
High	57	1.5	28.9	16.3	1.7	-	-
Hilchemakaar	1924	2.0	4.0	1.7	3.6	2.0	-
Kejimkujik	106017	4.4	28.0	5.5	5.5	7.5	62
Liberty	--	-	2.7	-	2.0	0.1	-
Little Liberty	--	-	6.5	-	1.5	-	-
Little Peskowesk	157	1.4	55.8	34.0	1.6	-	23
Little Red	140	0.7	19.4	23.1	1.7	-	-
Loon	1471	2.0	983.7	418.5	3.1	3.6	66
Lower Silver	451	1.8	6.5	3.1	2.1	3.6	-
Luxion	1420	3.0	10.0	2.8	2.5	14.8	-
McGinty	61	1.4	22.9	13.9	1.4	-	30
Mountain	5790	4.3	6.0	1.2	3.3	-	-
Mud	72	1.0	87.5	71.9	2.0	0.7	23

Table B-3 (cont.) Morphologic Indices of 45 Lakes in Kejimkujik National Park

Lake	V m^3 x 1000	$\bar{z}$ m	A':A	WR	D_L	I (%)	P (%)
North Cranberry	498	1.4	10.5	5.0	2.4	0.4	-
Pebbleloggitch	474	1.4	4.8	2.4	2.2	-	-
Peskawa	12249	3.2	35.6	3.7	2.6	0.4	30
Peskowesk	26231	3.8	26.6	2.2	3.1	7.0	23
Poplar	--	-	6.8	-	2.3	2.0	43
Puzzle	911	2.7	6.2	2.0	2.2	1.0	-
Snake	173	1.4	8.7	5.4	1.4	-	-
Upper Silver	566	2.3	3.7	1.3	2.0	-	-
Lake # 1	--	-	8.2	-	1.2	-	50
Lake # 7	--	-	7.2	-	2.7	-	50
Lake # 12	--	-	7.7	-	1.6	-	-
Lake # 13	--	-	71.4	-	1.0	-	-
Lake # 14	--	-	14.4	-	1.7	-	-
Lake # 15	--	-	4.3	-	3.1	1.0	-
Little Kempton Lake	36	1.4	31.9	18.8	2.2	-	-
Lake # 17	--	-	32.3	-	1.3	-	-
Lake # 24	--	-	133.3	-	1.1	-	19
Lake # 27	--	-	21.7	-	1.2	-	-
Lake # 28	--	-	64.9	-	1.6	-	-
Lake # 46	--	-	65.2	-	1.7	-	-

those which hold their water for longer periods of time. This is because each time the water is flushed away downstream, it carries with it accumulated nutrients such as phosphorous. At Kejimkujik, the shallow lake basins, the general "tilt" of the landscape toward the Atlantic Coast, and the high amount of rainfall all contribute to fairly high flushing rates in most of the lakes. Channel Lake flushes 139 times per year, George, 319, and Loon Lake, 418. These are the highest flushing rates within the Park. Beaverskin, Big Dam East, Hilchemakaar, and Mountain Lakes retain their waters for close to a year. These lakes, therefore, are more sensitive to nutrient loading, or other changes within their drainage areas.

Thermal Relations:

The relatively low volume to surface area ratios of most lakes results in rapid warming of the surface waters during the early summer. Smaller lakes may reach a maximum surface temperature of 26 degrees, and larger lakes about 23 degrees, by the end of July in some years. In smaller lake basins, wind-generated currents distribute the heat throughout the lake so that no real thermocline develops.

Most of the lakes that develop a thermocline show a steady decline in oxygen saturation in the bottom waters during the summer, as oxygen is used up by biological and chemical activity. This condition remains until the fall turnover, when surface waters cool to the point where they are denser than bottom waters, and the two mix together.

In a few lakes (George, Grafton, High, Loon, McGinty and Peskowesk), a complete absence of oxygen in bottom waters has been recorded in mid to late summer.

Mountain Lake is an exception to this pattern (Kerekes, 1973a). It shows an early and marked stratification, with a hypolimnion about five percent of the total lake volume (most other stratified lakes show a hypolimnion less than one percent). Bottom temperatures from this lake drop as low as 9 degrees, and the rate of oxygen uptake at these low temperatures is very slow. Mountain Lake has relatively clear waters, and light is able to penetrate to the bottom, resulting in some production of oxygen by algae below the metalimnion. The lower waters remain moderately well oxygenated therefore, and this condition is no doubt important for the continued existence of the Lake Whitefish population there. Table B-4 shows minimum low, maximum high and annual cycle of water temperatures for the Mersey River Flow Gauge Stations.

Colour

Park waters range from very clear (Lower Silver, Beaverskin, Cobrielle) to extremely coloured (Little Kempton, Snake Lake) (Kerekes, 1973a). Clear water lakes usually have a small drainage area, lacking peat deposits. The most heavily-coloured waters have larger drainage basins relative to their size, and are associated with sphagnum bogs. The dark brown colour of these waters is caused by decomposition products (mainly humic acids) of peat and bog vegetation. Further breakdown of these dissolved organic compounds by bacteria is an oxygen-consuming process and there is consequently a general undersaturation of oxygen in highly-coloured waters. These lakes also have relatively low rates

... text continued p. B-22

Table B-4 Minimum Low and Maximum High Water Temperatures (°C)

Recorded daily and classified monthly for the Mersey River flow-gauge stations below Mill Falls and George Lake and the recording station at Merrymakedge Beach, Kejimkujik Lake.

The upper line is Mill Falls, the centre line is Kejimkujik Lake, and the lower line is George Lake in each month.

Month	1968		1969		1970		1971		1972		1973	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
Jan.			0.0	0.6	0.0	0.8	0.0	0.8	-	-	0.6	1.9
			0.0	1.1	0.0	1.1	0.0	1.1	0.0	1.7	0.0	0.8
			0.0	1.1	0.0	2.5	0.0	2.2	0.8	1.7	0.0	1.7
Feb.			1.1	1.9	0.0	0.8	0.0	1.1	-	-	0.6	1.7
			0.6	1.1	0.6	1.4	0.0	0.0	1.1	2.5	0.6	1.7
			1.1	2.2	0.6	2.5	0.6	1.7	0.0	2.8	1.1	1.1
Mar.			0.6	3.0	0.6	3.0	0.0	2.8	-	-	0.6	5.0
			0.0	2.2	0.8	2.8	0.0	1.1	0.0	3.9	0.6	3.9
			1.4	4.1	2.2	4.4	0.0	3.9	0.8	4.4	1.7	2.8
April			1.4	11.0	2.2	12.1	2.2	9.1	-	-	3.0	12.1
			1.9	9.1	1.9	16.0	1.1	5.2	1.1	5.5	3.0	8.5
			4.4	9.4	4.1	11.3	3.3	6.6	4.1	8.3	2.2	12.1
May			9.6	17.3	10.7	13.5	8.5	16.8	6.3	17.6	12.1	17.1
			8.3	16.2	13.5	20.1	5.0	19.5	5.5	17.9	8.8	12.1
			9.9	16.8	11.6	17.9	6.9	16.0	8.3	17.6	12.1	15.4
June			16.2	18.2	12.4	17.3	16.8	21.5	-	-	17.6	22.6
			15.7	25.0	17.1	23.1	15.4	22.8	16.8	22.6	14.0	19.5
			17.1	22.3	17.1	20.6	16.2	22.8	17.6	23.1	16.5	20.9

Table B-4 (cont.) Minimum Low and Maximum High Water Temperatures

Month	1968		1969		1970		1971		1972		1973	
	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High
July	19.0	24.8	20.6	24.8	16.8	25.9	19.8	24.2	-	-	20.4	23.1
	21.2	29.2	18.4	23.9	19.8	30.5	19.5	25.3	21.2	25.6	18.4	22.6
	18.4	23.7	21.7	24.5	19.8	27.5	22.0	25.3	22.0	23.9	21.5	23.7
Aug.	18.4	23.7	20.9	24.2	19.0	25.9	20.1	25.3	-	-	21.5	22.6
	19.5	29.4	19.8	23.7	21.5	28.3	18.4	23.4	19.0	23.7	19.8	22.8
	20.1	24.8	20.9	24.2	21.2	27.2	19.3	26.1	19.8	23.7	22.6	26.1
Sept.	15.4	19.5	16.5	22.3	15.1	18.2	7.7	23.4	-	-	14.9	22.0
	15.1	23.4	15.4	23.4	16.0	22.3	13.8	24.8	12.4	22.0	13.8	22.0
	17.6	22.0	15.7	23.1	17.1	19.8	15.4	23.4	15.7	21.2	16.0	26.4
Oct.	8.8	18.4	6.3	16.0	6.9	15.1	5.0	13.8	-	-	8.3	14.9
	7.7	22.3	8.0	16.5	10.5	18.2	10.7	13.8	-	-	8.5	18.7
	11.0	17.9	9.4	16.2	9.9	17.3	11.8	15.4	8.3	17.1	7.7	15.4
Nov.	1.9	7.2	2.5	11.6	4.4	7.7	0.8	8.0	-	-	2.2	5.5
	2.8	10.5	3.3	9.6	3.3	11.3	0.6	10.5	-	-	1.4	9.9
	4.4	9.4	4.7	9.9	5.5	9.6	2.8	12.1	2.8	8.0	2.8	4.4
Dec.	0.0	3.3	0.3	4.7	0.0	4.4	0.0	2.2	-	-	2.2	3.9
	0.0	4.1	0.0	3.0	0.3	3.3	0.0	4.4	0.0	1.7	0.6	4.7
	0.6	4.7	0.3	4.1	0.6	5.0	0.0	2.2	-	-	2.8	3.9

of primary production and the organisms living in these water bodies are trophically dependent on the bacterial processing of these dissolved organic compounds washed in from the bogs.

Hydrogen Ion

All lakes in the Park are naturally acidic, and with the exception of Big Dam East, Grafton and McGinty, pH values are generally well below 6. The granite and quartzite bedrocks and the soils derived from them contain very few buffering compounds such as calcium and bicarbonates. Thus waters are poorly buffered with fluctuating pH values from season to season. Lakes whose drainage comes from slatey tills (e.g. Grafton, Big Dam East) tend to be slightly better buffered, and their pH correspondingly less acid. (Pers. comm. Kerekes, 1984.)

Chemical Characteristics

All waters in the Park are exceptionally low in dissolved solids (Kerekes, 1973b). Salinities range from 11.8 mg/l to a little over 20 mg/l. Poor soil development and surface geological deposits that are resistant to erosion are primary causes of salinity values that are extremely low compared with most of the world's fresh water.

The major ions in solution are sodium and chloride. This indicates that much of the dissolved material in the surface waters is derived from precipitation, and not from the solution of underlying rocks in the watershed.

The Park waters are very low in calcium and bicarbonate ions. Both of these are important constituents of the "buffering" system, whereby variations in pH are resisted by changes in the solubility of the carbonates. In the extremely soft waters of Kejimkujik any change in carbon dioxide levels will cause a change in the pH because there are few buffers present. In addition, peat bogs act not only as a source of sulphates, but as absorbers of calcium, thus influencing pH conditions further.

An important component of the Park waters is silica. Although silica concentrations are generally within the expected limits, the absence of other minerals and salts means that silica becomes a major ion in solution. Most of the silica is brought into the lakes by solution from rock in the watershed. Silica values are generally lower in summer when it is taken up by diatoms, and higher in winter when diatom populations are low and grow very slowly.

Phosphorous is a major nutrient for plant growth; in Kejimkujik it is found in very low concentrations, and is the limiting factor for primary productivity (pers. comm. Kerekes, 1984). These low values are a direct result of the resistant granites and quartzites of the drainage areas. In addition, the high rate of flushing in many lakes means that what little phosphorous does accumulate in one form or another is washed away downstream. For example, relatively high phosphorous values have been recorded from the bottom waters of Loon and George Lakes during the period of thermal stratification. This phosphorous, however, is essentially "locked" away from use by phytoplankton in the upper layers, because there is no mixing between the different water layers. When the lakes turn over, the high flushing rate means that the phosphorous is carried away. In lakes which do not flush as rapidly, any addition of phosphorous (e.g. from sewage or fertilizer) would markedly alter the character of that system.

Productivity

If waters were ranked on a scale of biological productivity, several lakes at Kejimkujik would be considered quite low (pers. comm. Kerekes, 1979).

Concentrations of chlorophyll A are used as indicators of primary productivity. In a study of 27 lakes, most were found to be of low productivity (oligotrophic), with chlorophyll A levels generally below 3 mg/m^3. These values are comparable with natural (unpolluted) lakes on the Canadian Shield in Ontario (Armstrong and Schindler, 1971). In lakes that undergo thermal stratification, surface concentrations of chlorophyll A are somewhat higher than deeper waters. However, these lakes also have a high flushing rate, so that there is little opportunity for nutrients to accumulate.

There are many variations on this pattern. McGinty Lake, for example, undergoes stratification, but owing to its shallow depth, light is able to penetrate to the bottom (3.5 m). As a result, chlorophyll A concentrations as high as 150 mg/m^3 have been recorded near the bottom, indicating extremely high productivity of algal populations. There is no mixing during the summer, however, and so the epilimnion is poor in nutrients and productivity low. This is in effect "upside-down" from other lakes which generally show the upper waters to be more productive than the lower.

Another "upside-down" effect occurs when comparing clear and coloured water lakes and their productivity. It had been assumed that the clear water lakes would show more productivity since light can penetrate to the bottom in most cases. At Kejimkujik, however, the extremely low phosphorous concentrations mean that clear water lakes have lower productivity than dark water lakes, which have some nutrient loading from the organic acids and debris associated with the bogs.

It would appear from the data, then, that the organic debris from the bogs not only colours the water, but provides a source of food for certain bacteria which can decompose it. These bacteria in turn are a source of food for filter feeding creatures (e.g. rotifers), which are in turn food for other organisms. These bacteria use oxygen as they decompose organic debris, and some depletion of oxygen in the middle or bottom waters may occur. The surface water is normally well oxygenated because of the effects of wind stirring air into the water.

There is a great deal of variability among the lakes, each having its own particular characteristics. While some lakes may contain more phosphorous than others, some of it may not be in a usable form (particularly in coloured waters) and the pathway of phosphorous through the food chains is not well known (pers. comm. Kerekes, 1984).

Acid Rain

The phenomenon known recently as Acid Rain has probably been occurring since the Industrial Revolution. The major components of the pollutants are sulphur and nitrogen oxides given off when fossil fuels are burned. In the past, the effects of these chemicals have been localized to fall-out areas around the smokestacks of various industries. The real problem has arisen during the last twenty years (in Canada) since the building of taller smokestacks which release the pollutants into the continental air masses. This has occurred in all the major industrial areas in the United States and Canada, and has resulted in the deposition of these chemicals not at their source, but in areas down-wind of the source. Although estimates vary, it would appear that much of the acid rain falling on the Atlantic Provinces comes from industrial complexes to the west and southwest.

The effects of acid rain are not the same from area to area. For example, the precipitation falling on the Annapolis Valley of Nova Scotia is as acidic as that falling on Kejimkujik. However, the bedrock and soils of the valley contain many more chemical buffers (notably calcium and bicarbonates) than the granites and quartzites found at Kejimkujik. The effects of acid rainfall on such "rich" areas as the valley are, at present, being neutralized by these chemicals.

Kejimkujik National Park lies within a zone of bedrock that has been deemed very sensitive to the deposition of acidity. Calcium concentrations in surface waters are among the lowest in the world (Kerekes, 1983a). In addition, in lakes whose water drains through bogs, there will be increased acidity as a result of the solution of organic acids from the bog. The waters in Kejimkujik are thought to have been acidic in nature before the addition of sulphates from acid rain, with the coloured lakes being more acidic than the clear water lakes.

In the early 1970's Dr. J. Kerekes began base-line data collection for twenty-seven lakes in Kejimkujik. During the late 1970's, a monitoring station to measure acid precipitation was established behind the warden housing complex. Since that time, new and more sophisticated equipment has been added to the monitoring station, and several national and international committees are now involved in the analysis of data from this station (Fig. B-6). In the early 1980's, detailed examination of two lakes was undertaken by the LRTAP (Long Range Transport of Airborne Pollution) study group. The two lakes selected were Beaverskin (clear water) and Pebbleloggitch (dark water). These two lakes were chosen for a number of reasons, notably that they were geographically removed from the effects of localized pollution; they were similar in size, and there was baseline data for both from Kerekes' original 1971 studies. Many different scientific disciplines have been involved in this study, including hydro-ecologists, forest ecologists, hydrologists, soil biologists, etc. The results of this intensive monitoring of the passage of rainfall through the system are still not complete, and many new questions are being raised, not only with regard to the effects of acid precipitation, but also to the functioning of the complex association of soils, plants, and water.

... text continued p. B-34

Figure B-2 the pH of Precipitation Observed at Kejimkujik National Park, January - April 1984 (Mullen, J.; B. L. Taylor, 1985)

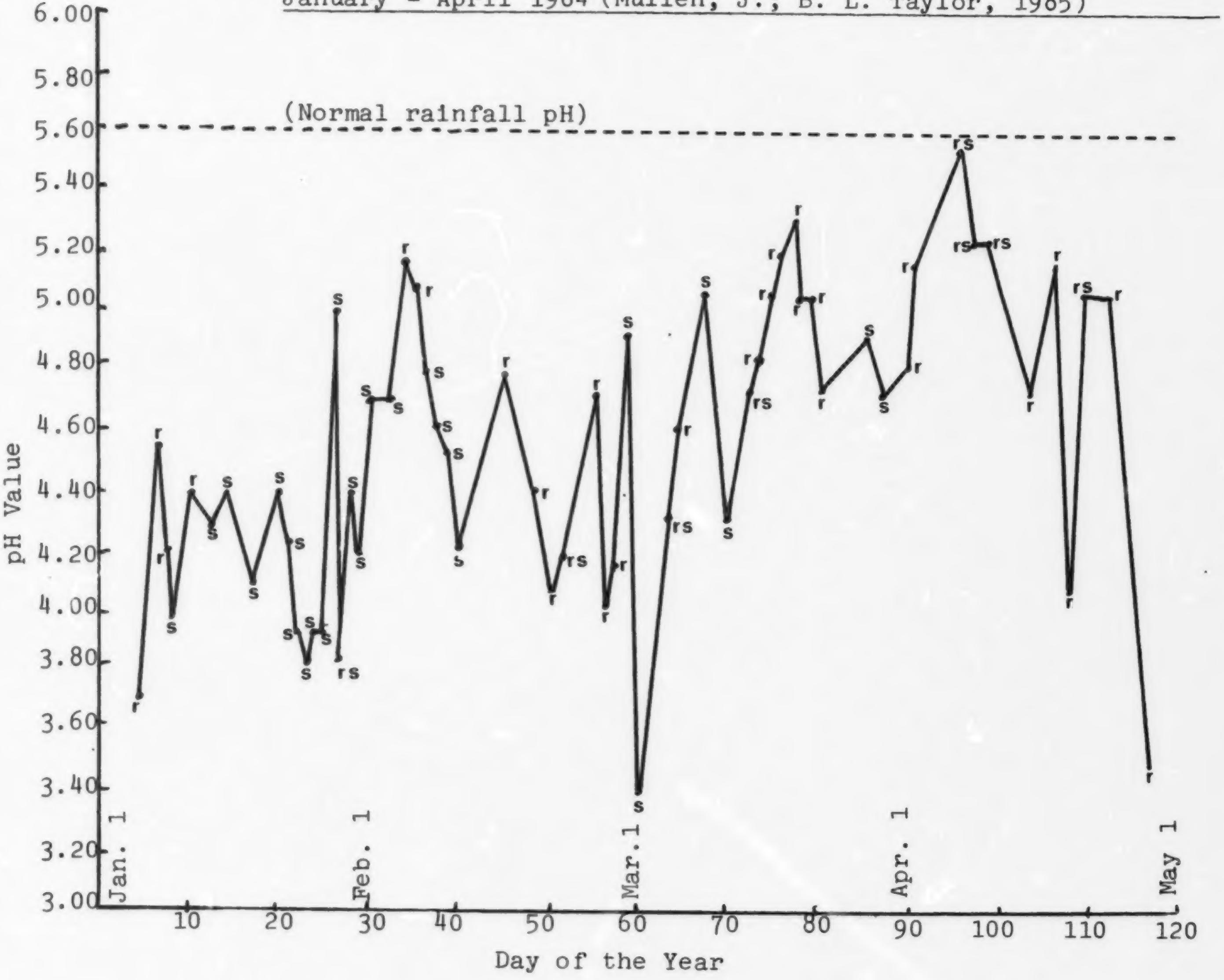
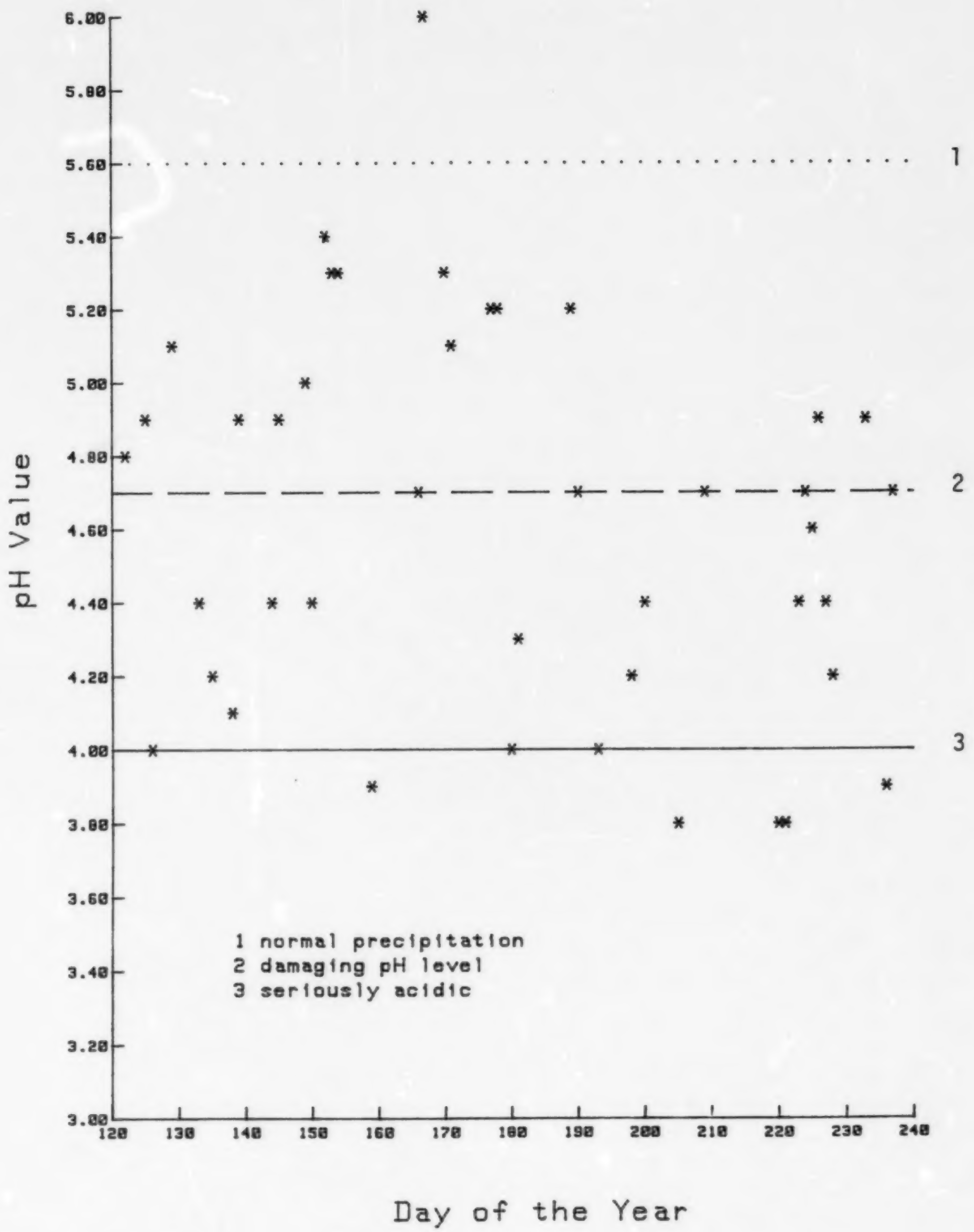


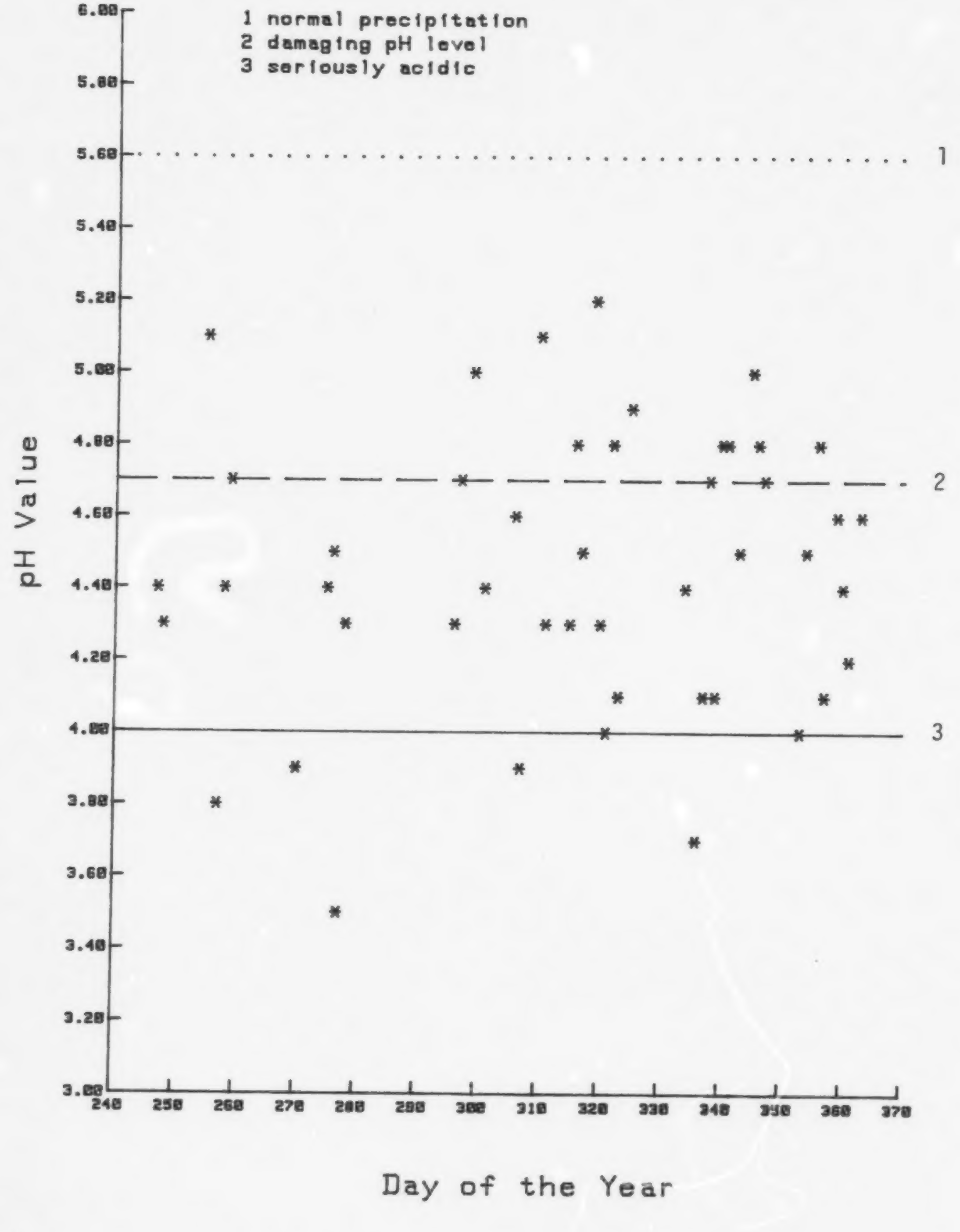
Figure B-2



Precipitation at Kejimkujik, N.S.

May - August 1984

Figure B-2



Precipitation at Kejimkujik, N.S.

September - December 1984

Figure B-2

Precipitation at Kejimkujik, N.S.
January - April 1985

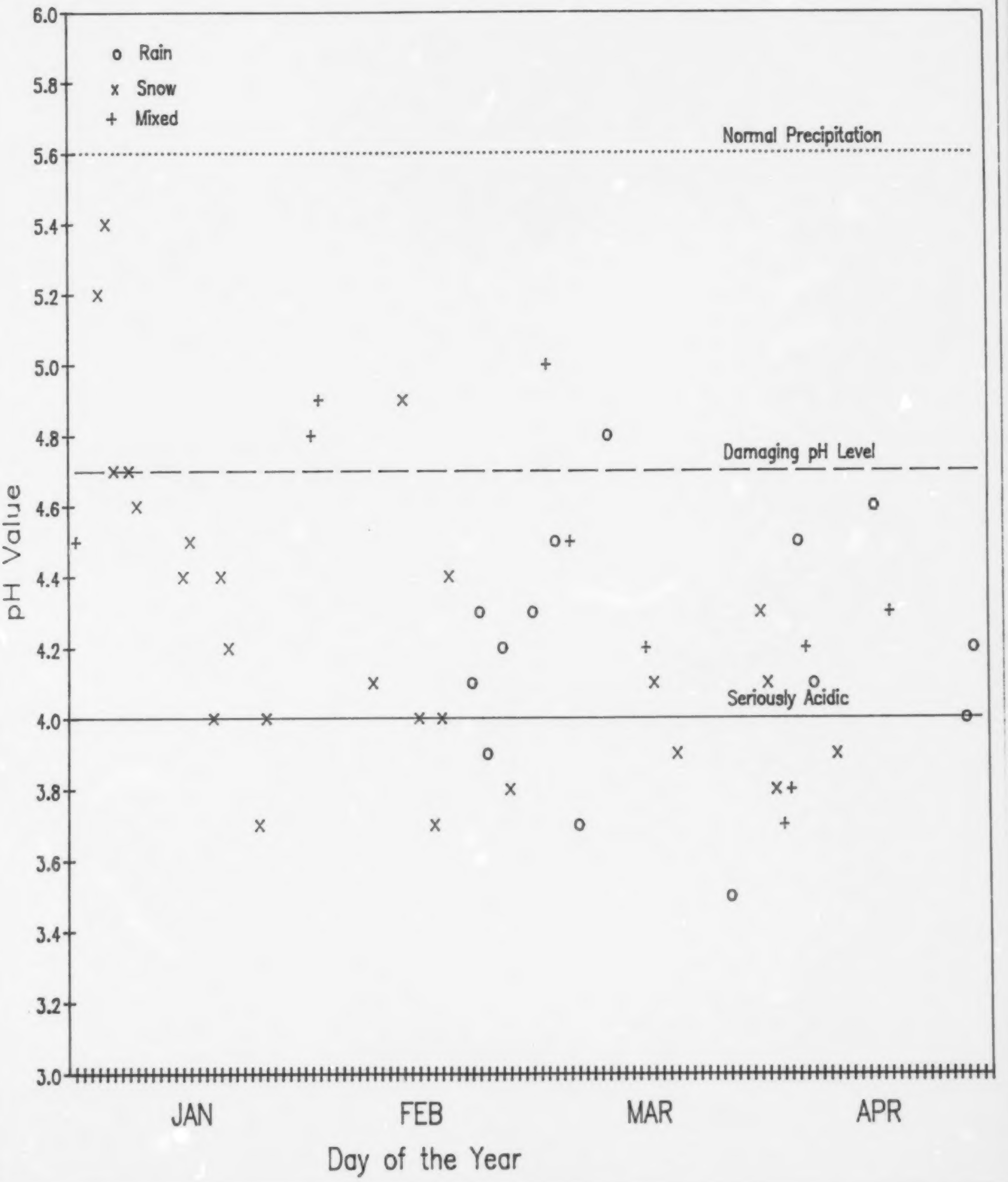


Figure B-2

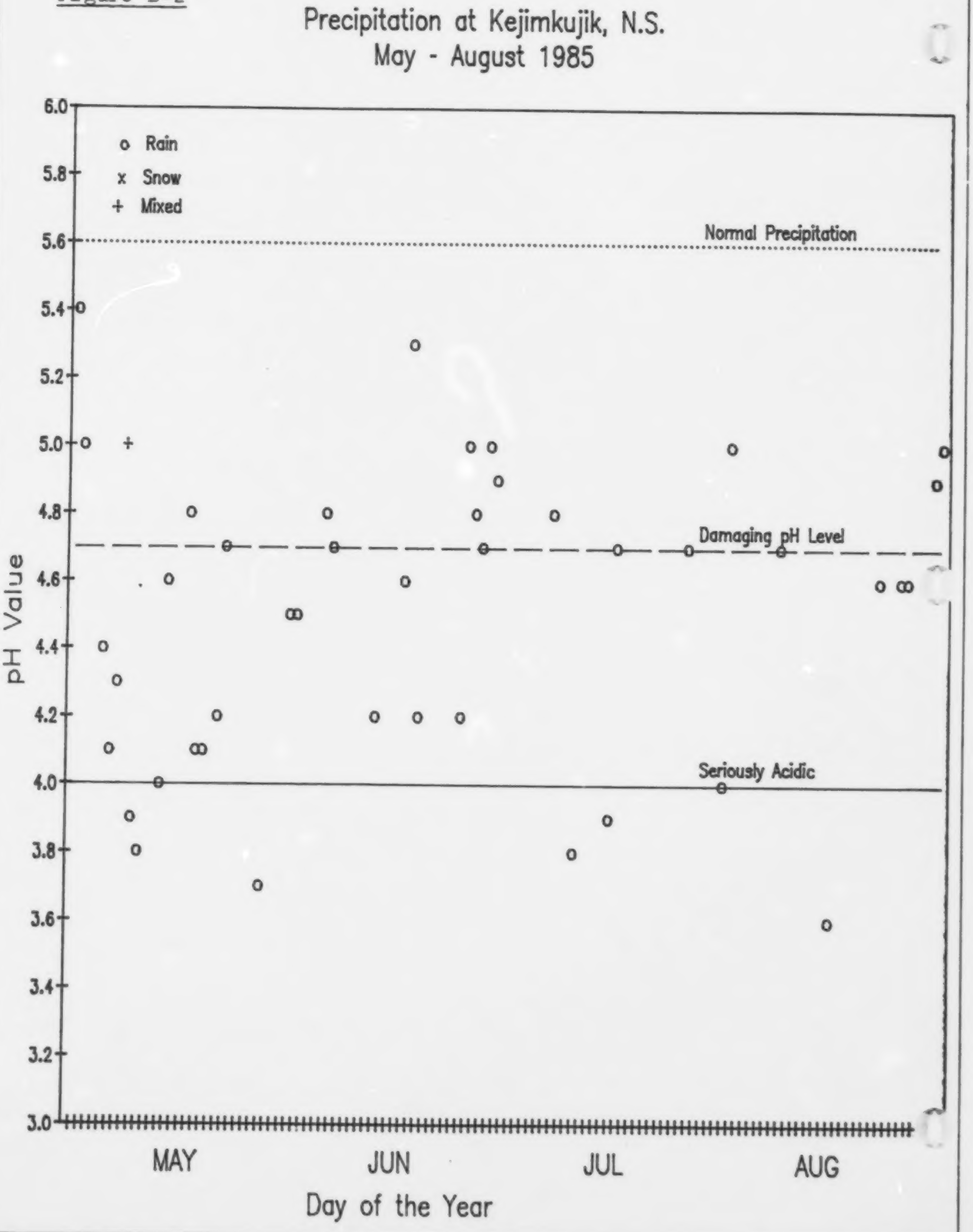
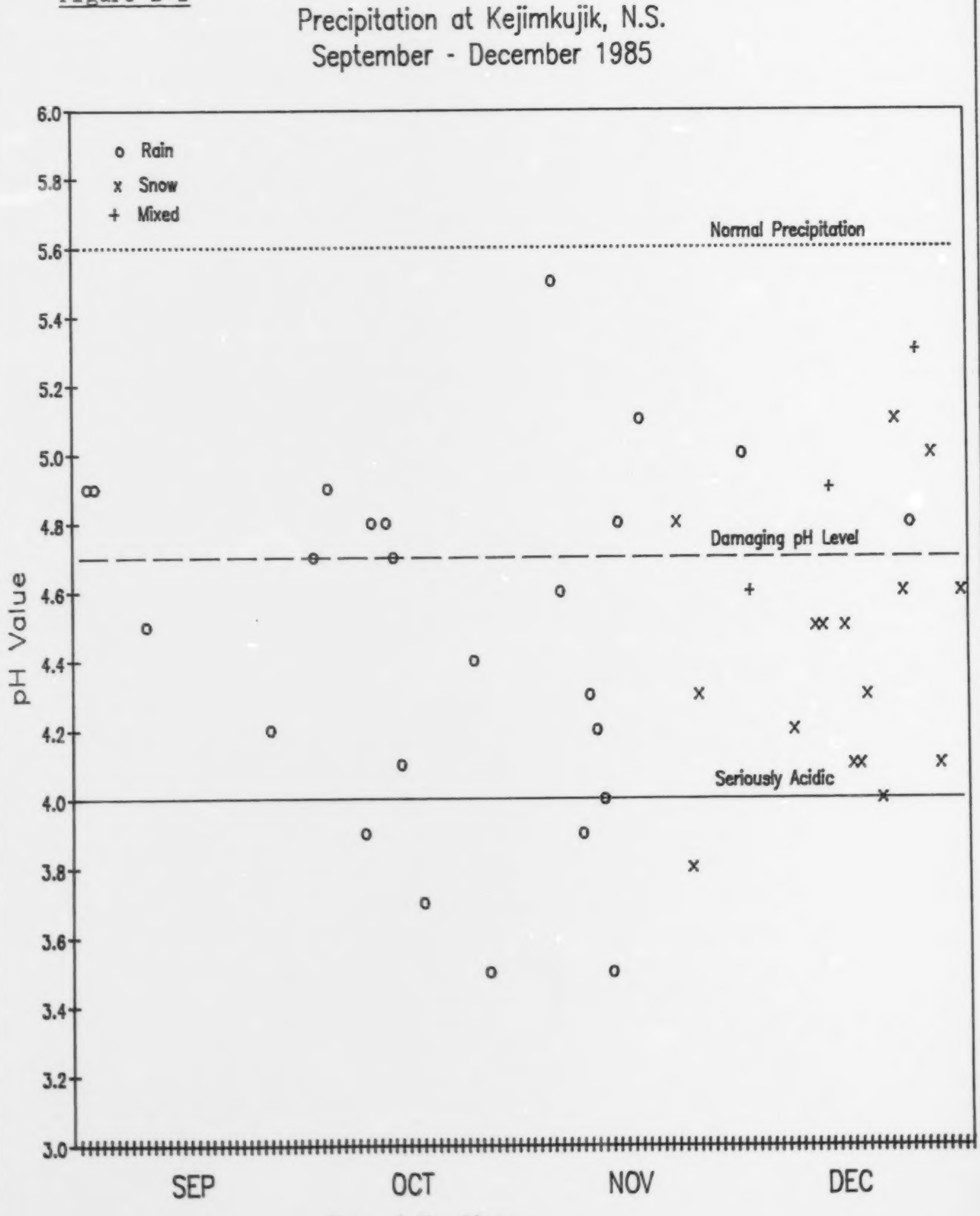

Precipitation at Kejimkujik, N.S.
May - August 1985
o Rain
x Snow
+ Mixed
Normal Precipitation
Damaging pH Level
Seriously Acidic
pH Value
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
4.2
4.0
3.8
3.6
3.4
3.2
3.0
MAY
JUN
JUL
AUG
Day of the Year

Figure B-2


Precipitation at Kejimkujik, N.S.
September - December 1985
o Rain
x Snow
+ Mixed
Normal Precipitation
Damaging pH Level
Seriously Acidic
pH Value
6.0
5.8
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SEP
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DEC
Day of the Year

At Kejimkujik the annual wet deposition of sulphates (SO_4) in precipitation is estimated to be about 20 kg/ha. While there is no doubt that deposition occurs during dry periods as well, techniques for measuring this "dry deposition" have not been very accurate. Kerekes (pers. comm. 1984) estimates that possibly one third as much again falls as dry particulate matter.

Studies of the wet deposition of air pollutants at Kejimkujik have shown that a substantial part of the total annual deposition occurs on only a few days in the year. These occasions of large deposition are referred to as episodes. Studies are under way to determine the possible reasons for this phenomenon. (Taylor, Workshop Proceedings, LRTAP, April 1983.)

. Evaluation:

Management Objectives:

1. To insure the natural biophysical content and hydrological characteristics of the lakes and rivers of Kejimkujik are maintained through the protection of drainage basins from unnatural erosion, and physical or chemical modification.

2. To protect selected watersheds, which exhibit representative water conditions and biological content, for scientific study, and for non-consumptive recreational purposes.

3. To insure no exotic species are introduced to the aquatic system in Kejimkujik National Park.

4. To maintain a co-operative relationship with land owners (private and crown) outside Park boundaries to insure activities which might impact on hydrological systems within Kejimkujik are minimized.

Unique, Critical and Representative Areas:

Unique hydrological features of Kejimkujik National Park include the successional development of Little Kempton Lake. This lake demonstrates a very late stage in hydroseral development.

McGinty Lake demonstrates high biotic productivity, with notable algal blooms.

Beaverskin Lake, Cobrielle Lake and the southern portion of Big Dam Lake display uncommonly clear waters for southwestern Nova Scotia. This phenomenon is probably caused by the fact that they are headwater lakes and by limited drainage basin dimensions, and ground water input.

Grafton Lake displays some of the lowest acidity (pH6) values and high productivity for Kejimkujik. It therefore contributes significant buffering capacity to the Hatchery Brook, which could serve as a fish refuge on the Mersey River watershed downstream.

Little Red Lake displays the highest acidity values in Kejimkujik with pH 4.3 (field) and pH 4 (lab) (Kerekes 1974). Consequently Brook Trout are unable to survive in the waters of Little Red Lake.

Pebbleloggitch Lake, Beaverskin Lake and their associated watersheds are being used as study areas for the international Long Range Transport of Air Pollutants (LRTAP) research programme. As such detailed research on all elements of their hydrology is being carried out by various agencies.

Resource Management Concerns:

1. The waters of Kejimkujik National Park are particularly vulnerable to the effects of acid precipitation, as documented in the Long Range Transport of Air Pollutants research programme. Low carbonate content, and the acidification effect of bog runoff may exacerbate this problem. The marginal pH status of many Park lakes and rivers thus threatens fish, amphibian and invertebrate populations directly, with subsequent indirect effects on higher levels in the trophic system. It is already becoming evident that Brook Trout are unable to survive some of the Park's more acid lakes. A similar threat may exist for some of the Park's aquatic plants including *Hydrocotyle umbellata*, the Water Pennywort, which is among Canada's rarest plants. The release of toxic ions from the substrate as a result of leaching is also a potential problem.

2. Several drainage basin systems feeding Kejimkujik National Park's lakes and rivers lie in part outside Park boundaries. There exists, therefore, a potential for activities outside the Park to affect water quality within Kejimkujik. These include improper sewage disposal, erosion and water chemistry alteration caused by improperly buffered land use practices, chemical run-off from forestry and agricultural applications, and water depletion by dams. These problems will tend to be intermittent and irregular in nature, making rapid detection difficult. Impacts will also be difficult to monitor as species most vulnerable will be more often affected during the immature phase (as in decreased survival of fish eggs and fry). Co-operative

relationships with land owners outside Park boundaries, and an appropriate water quality monitoring programme will help minimize the potential for these problems.

3. Since the construction of the Fish Hatchery at Grafton Lake, a dam has been in place which artificially influences water levels. While the limnological conditions in the lake are among the best in the Park (Table B-5), natural movement of fish, and perhaps reptiles, continues to be restricted in Grafton Brook. Restoration of fish spawning access would increase the productivity potential of the Grafton Lake watershed and probably improve the fish stocks in the Mersey River system nearby. Proper water level control at Grafton Lake should also be insured to prevent inappropriate flooding or drawdown out of phase with normal seasonal fluctuations. This can be a critical aspect for littoral and shoreline biota.

Research Requirements:

Research on the nature of environmental acidification in Kejimkujik National Park has resulted in some important modifications of traditionally-held limnological theories. However, significant gaps remain in knowledge relating to the impact of environmental acidification. Specifically, there is an incomplete understanding of the impact of acid rain on soils, aquatic vegetation, invertebrates, amphibians and fish, along with related elements in the trophic system. It is important to consider that laboratory results cannot always be directly related to conditions in the field. Indeed, it is suspected that the ionic content of Park waters coupled with genetic adaptations of the species concerned could strongly influence the ecological significance of low environmental pH in Kejimkujik watershed systems.

Table B-5 pH Values for Upper Mersey, Lower Mersey and Grafton Brook, 1978 - 1982

Season/Year	Upper Mersey			Lower Mersey			Grafton Brook		
	High pH	Low pH	Mean pH	High pH	Low pH	Mean pH	High pH	Low pH	Mean pH
Winter 1978	5.10	4.40	4.75	5.40	4.40	4.88	6.40	6.10	6.25
Spring 1978	5.20	4.70	4.88	5.20	4.70	4.88			
Summer 1978	6.30	5.10	5.30	6.20	4.80	5.17			
Fall 1978	6.00	4.90	5.24	5.70	4.70	5.20			
Winter 1979	4.82	4.50	4.59	5.10	4.50	4.67	5.49	5.10	5.31
Spring 1979	5.10	4.60	4.78	5.10	4.60	4.82	5.99	5.40	5.74
Summer 1979	5.11	4.79	4.91	5.15	4.80	4.93	6.02	5.76	5.88
Fall 1979	5.05	4.70	4.85	5.20	4.75	4.92	5.95	5.44	5.81
Winter 1980	5.30	4.50	4.76	5.05	4.58	4.75	5.65	5.20	5.49
Spring 1980	4.89	4.61	4.73	4.80	4.58	4.69	5.85	5.16	5.61
Summer 1980	5.85	4.88	5.04	5.14	4.45	4.85	5.97	5.78	5.85
Fall 1980	5.36	4.70	4.98	5.40	4.80	5.01	5.95	5.69	5.87

Table B-5 (cont.) pH Values for Upper Mersey, Lower Mersey and Grafton Brook, 1978 - 1982

Season/Year	Upper Mersey			Lower Mersey			Grafton Brook		
	High pH	Low pH	Mean pH	High pH	Low pH	Mean pH	High pH	Low pH	Mean pH
Winter 1981	4.71	4.29	4.59	4.72	4.32	4.60	5.51	4.68	5.25
Spring 1981	4.89	4.51	4.72	4.79	4.51	4.66	5.80	5.40	5.57
Summer 1981	6.06	4.87	5.06	5.12	4.78	4.96	6.09	5.44	5.78
Fall 1981	5.21	4.55	4.89	5.11	4.82	4.98	5.98	5.60	5.86
Winter 1982	4.82	4.59	4.70	5.06	4.48	4.73	5.85	5.01	5.32
Spring 1982	4.91	4.50	4.70	4.80	4.50	4.65	5.90	5.00	5.46
Summer 1982	5.22	4.76	4.99	5.12	4.68	4.95	6.11	5.61	5.84
Fall 1982	5.32	5.02	5.15	5.22	4.98	5.12	5.99	5.78	5.91

Environmental acidification has the potential of causing the release of toxic metal ions from the substrate. The behaviour of these ions in the context of humic acids present in many of the Park's lakes and streams is not fully understood and needs further research.

Monitoring Requirements:

1. Continued monitoring and analysis of the quality of precipitation and watershed hydrology is necessary to determine and quantify the impact of acid rain on Park ecosystems. The presence of LRTAP research infrastructure in Kejimkujik will probably fulfill the requirements for information on this topic.

2. Disturbance of watersheds outside Park boundaries which supply rivers and lakes inside the Park can occasionally occur. Improper timber harvesting practices, accidental toxic chemical spills, sewage disposal and erosion can influence water supplies to the detriment of Park resource values and even human health. It is necessary to monitor Park lakes and rivers regularly, utilizing standard water sampling techniques, to detect the presence of pollution problems.

Opportunities:

There are many aspects of Kejimkujik's hydrology and limnology which might provide opportunities for interpretation. The historical use of waterways as "highways" by native and white North Americans; the presence of a variety of aquatic reptiles, amphibians, birds and mammals, and the edge communities of aquatic coastal plain plants are potential topics of interest. The role of water and ice in the development of Kejimkujik's topography, bog formation and succession also represents potential for interpretation.

Similarly, there are a variety of opportunities for scientific study of hydrology and limnology in Kejimkujik National Park. The waters of Kejimkujik represent a transition between the acidified lakes and rivers of granite-underlain drainage basins, and the more buffered waters on moderated drainage basins underlain by carbonate-leaving bedrocks. The aquatic flora and fauna of Kejimkujik thus represent members of a marginal ecosystem, limited by low nutrient and high environmental acidity.

The waters of Kejimkujik National Park represent an important focus for recreation. Canoeing and swimming will continue to be popular activities. Similarly, angling depends on good water quality. Appropriate watershed management and protection must be ensured, however, as the waters of Kejimkujik have little tolerance for change without significant impact on resource and recreational values.

Limitations:

Kerekes (Aquatic Resources Inventory, Part 2, 1974) points out several specific recommendations with regard to the highly sensitive water systems within the Park.

1. Careful control of any nutrient loading both within the Park (sewage) and from outside must be maintained.
2. The dispersal of hydrocarbon pollutants such as those from gasoline outboard motors must be carefully controlled.

The general water quality of all Park lakes and rivers must be assured if the resource values and recreational opportunities are to be preserved in Kejimkujik National Park. Water from lakes and rivers in the Park should be routinely boiled before being used for drinking.

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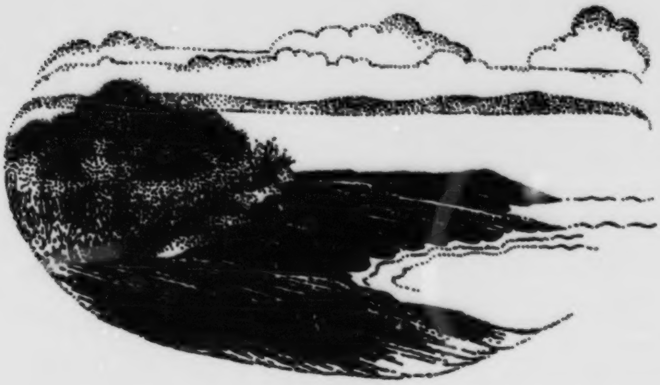
BEDROCK GEOLOGY



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Characteristics of the Bedrock of Kejimkujik National Park C-5

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Description:

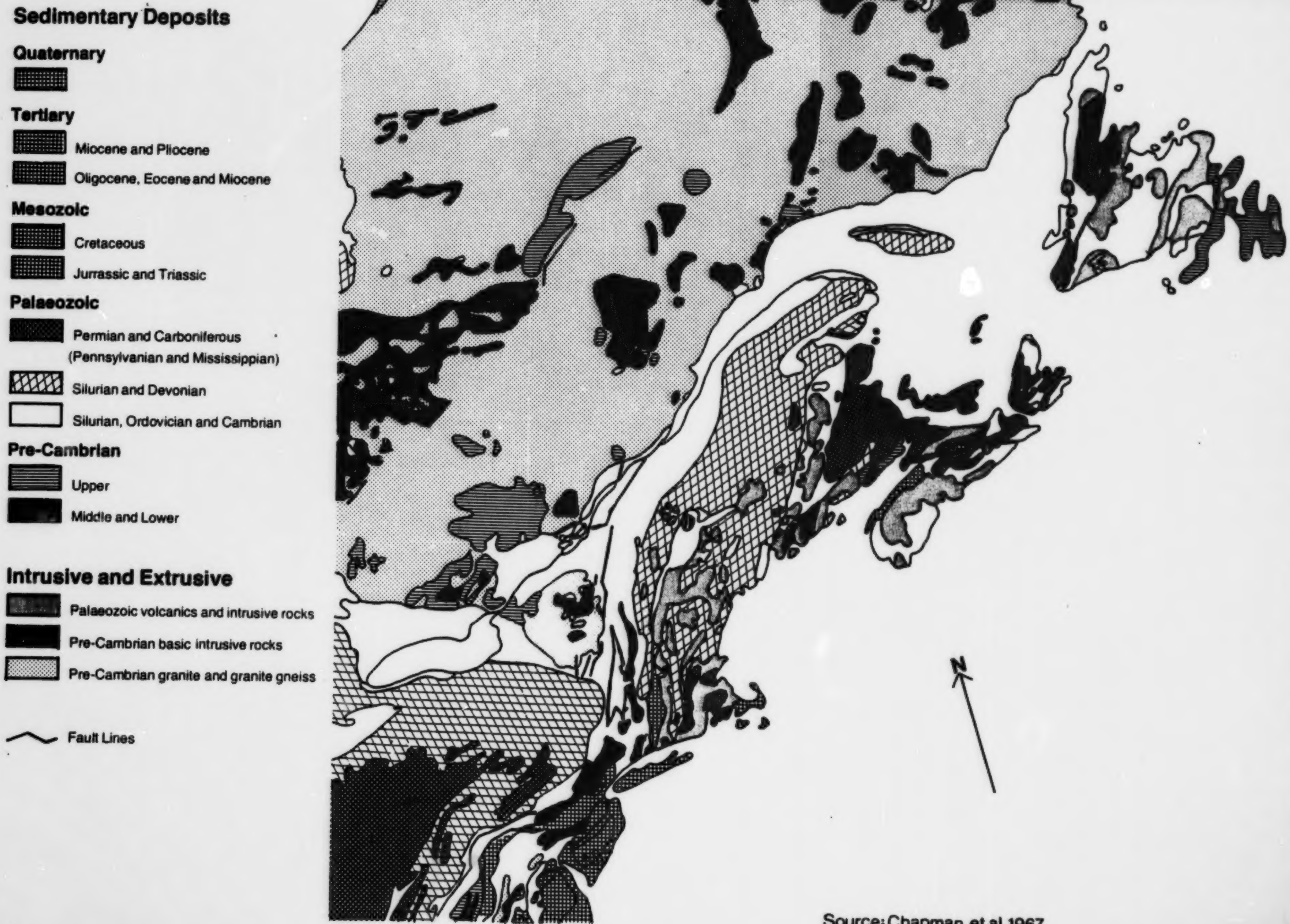
Kejimkujik National Park and the southern part of Nova Scotia belong to a large geologic unit known as the Meguma Zone or the Atlantic Uplands. This unit is part of a complex geologic structure (the Appalachian System) forming the east coast of North America (Figure C-1).

Two major rock types are found in Kejimkujik National Park and vicinity (Figure C-2). The Meguma Group consists of the Halifax Formation (slates and schists) overlying the Goldenville Formation (greywacke and quartzites). Both formations are sedimentary in origin. The second major rock type, comprised of the granites, is igneous in origin. (For a Glossary of Terms see page C-15.)

The Meguma Group is of great interest since it is "foreign" to the rest of the Appalachian System. The sediments that make up these rocks were deposited during the Cambrian to Middle Devonian (600 to 370 million years ago). At that time what is now North Africa lay closer to North America. Large amounts of sediments from this early African landmass were transported from its continental shelf to the mid-oceanic trench separating the two continents. These deposits resulted in the thick, uniform layers of the Goldenville and Halifax Formations.

During the Middle Devonian (360 million years ago) Europe and North Africa moved to meet the North American continent. This period, called the Acadian Orogeny, resulted

Figure C-1
Geology of
Eastern N[illegible] America


Sedimentary Deposits
Quaternary
Tertiary
Miocene and Pliocene
Oligocene, Eocene and Miocene
Mesozoic
Cretaceous
Jurrassic and Triassic
Palaeozoic
Permian and Carboniferous (Pennsylvanian and Mississippian)
Silurian and Devonian
Silurian, Ordovician and Cambrian
Pre-Cambrian
Upper
Middle and Lower
Intrusive and Extrusive
Palaeozoic volcanics and intrusive rocks
Pre-Cambrian basic intrusive rocks
Pre-Cambrian granite and granite gneiss
Fault Lines
N

Source: Chapman, et.al, 1967.

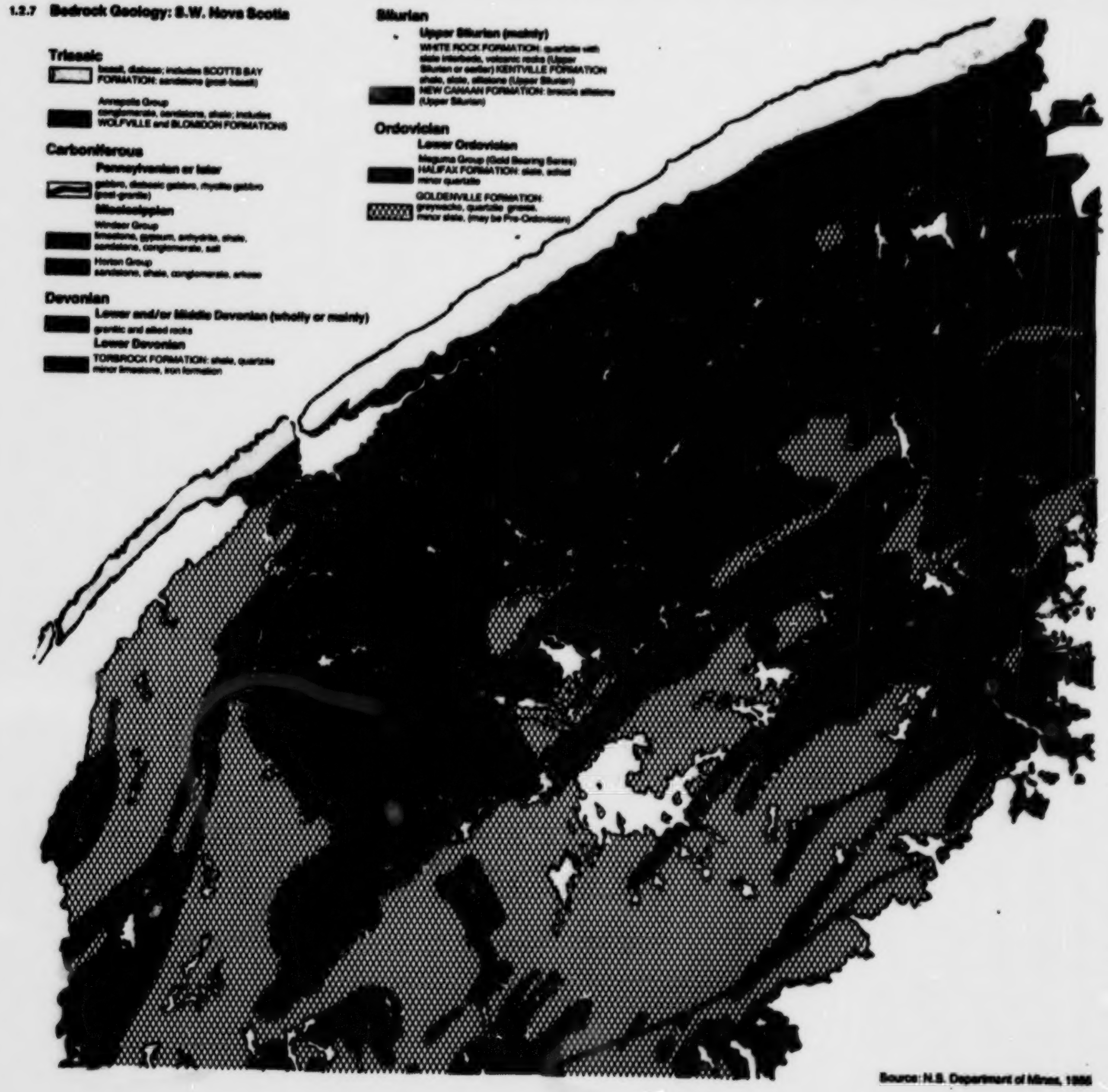
in the present-day geological entity of Nova Scotia. First, this period of geological upheaval caused the joining together of the Meguma with the rest of the province for the first time. Second, the shales and sandstones of the Meguma were folded into a series of synclines and anticlines. The sediments were metamorphosed into the present-day slates and quartzites by the pressures generated during this folding. During the Mesozoic, rifting occurred and the Meguma Group was left behind, "stuck" to North America, as the two continents separated and began the formation of the present-day Atlantic Ocean (Cooke, 1973).

The third major event during the Acadian Orogeny was the formation of large plutons of granite deep within the rising mountains. Some plutons were formed from molten material squeezed from the mantle into the crust, while others show evidence of being recycled from the melting of rocks that previously existed deep in the crust (Lang and Cumming, no date). Cumming (1979) believes that the granites of the South Mountain batholith were formed from the squeezing and melting of the Meguma.

While molten, these plutons intruded, under pressure, into the rock layers above them. At Kejimkujik, the granites of the South Mountain intruded into the Meguma. Where the two rock types met, contact metamorphism occurred (Figure C-2). The granites cooled slowly, deep within the crust, resulting in the coarse-grained solid mass which now dominates the western area of the Park.

Figure C-2

1.2.7 Bedrock Geology: S.W. Nova Scotia


Triassic
basalt, diabase; includes SCOTTS BAY FORMATION: sandstone (post-basalt)
Annapolis Group
conglomerate, sandstone, shale; includes WOLFVILLE and BLOMIDON FORMATIONS
Carboniferous
Pennsylvanian or later
gabbro, diabasic gabbro, mylitic gabbro (post-granite)
Mississippian
Windsor Group
limestone, gypsum, anhydrite, shale, sandstone, conglomerate, salt
Horton Group
sandstone, shale, conglomerate, arkose
Devonian
Lower and/or Middle Devonian (wholly or mainly)
granitic and allied rocks
Lower Devonian
TORBROCK FORMATION: shale, quartzite minor limestone, iron formation
Silurian
Upper Silurian (mainly)
WHITE ROCK FORMATION: quartzite with slate interbeds, volcanic rocks (Upper Silurian or earlier) KENTVILLE FORMATION shale, slate, siltstone (Upper Silurian)
NEW CANAAN FORMATION: breccia siltstone (Upper Silurian)
Ordovician
Lower Ordovician
Meguma Group (Gold Bearing Series)
HALIFAX FORMATION: slate, schist minor quartzite
GOLDENVILLE FORMATION: greywacke, quartzite gneiss, minor slate, (may be Pre-Ordovician)

Source: N.S. Department of Mines, 1965

Erosion of the Meguma over thousands of years has exposed the granite batholith (Figure C-3).

Characteristics of the Bedrock of Kejimkujik National Park:

1. The Meguma Group

Cumming (1979) indicates that the Goldenville Formation within the Park consists primarily of light grey to black biotite-quartzite, with a few beds of black micaceous slate. Typically, outcrops show a massive and flaggy rock, light to dark blue in colour, except near contact with the Halifax slates, where the quartzite is often greenish. These rock outcrops often look "rusty" due to the presence of pyrite and arsenopyrite.

The Halifax Formation, within the Park, ranges from light green to grey to black argillaceous (clayey) and siliceous (sandy) slates. It is a very thick formation, all the beds adding up to produce a depth of more than 3 kilometres. The slates are not uniform in their composition from top to bottom, and both Prest (1895) and Bailey (1898) listed a succession of the various colours and textures of the beds.

Another characteristic of the slates is a feature called "slatey cleavage". Metamorphosis of sediments in the Halifax slates while being folded during the Acadian Orogeny converted " . . . the minerals that formed the shales to minute flakes of mica which are arranged at right angles to the direction of

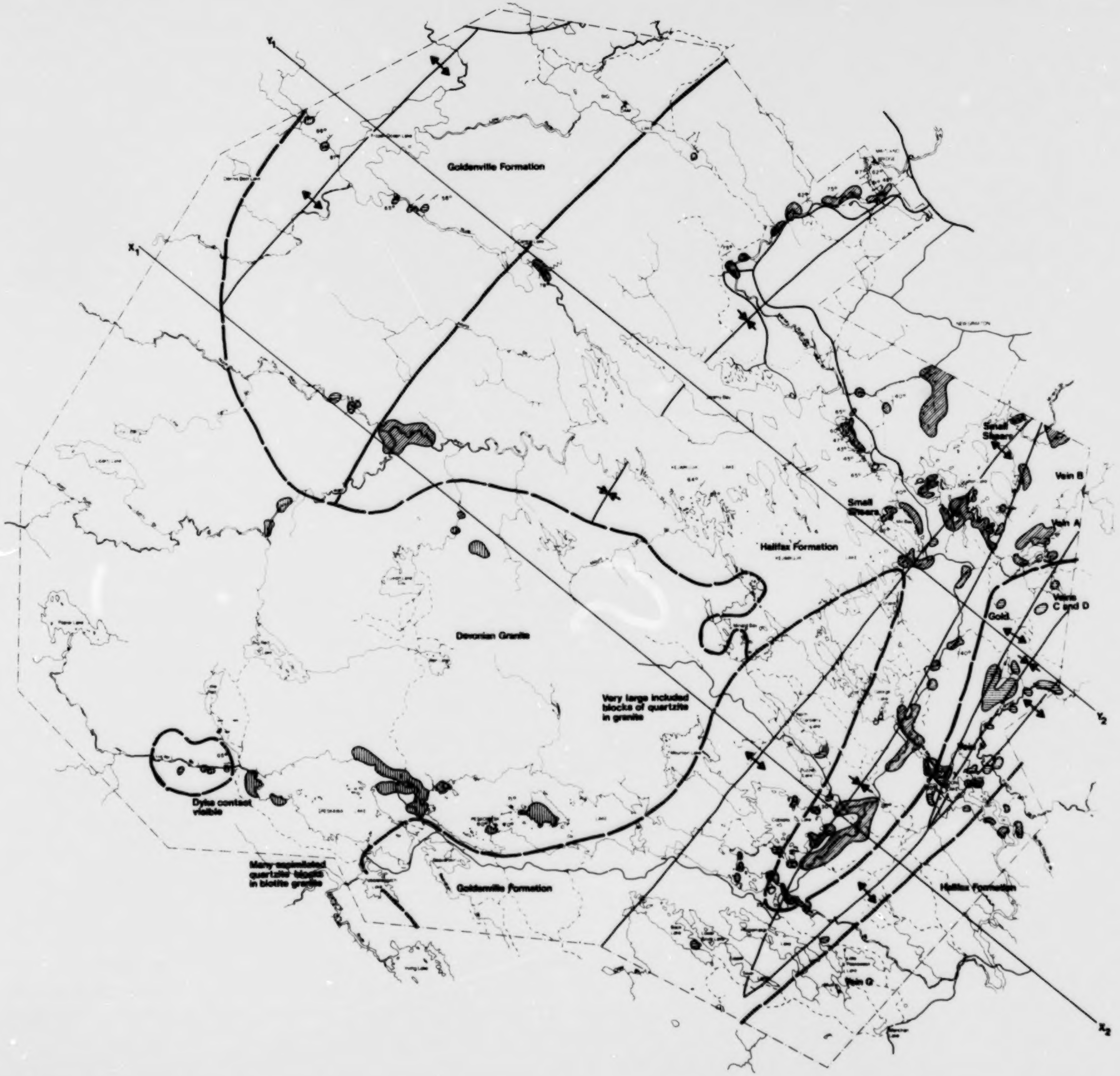

Y1
Goldenville Formation
X1
Halifax Formation
Small Shears
Small Shears
Vein B
Vein A
Veins C and D
Gold
Devonian Granite
Very large included blocks of quartzite in granite
Y2
Dyke contact visible
Many assimilated quartzite blocks in biotite granite
Goldenville Formation
Halifax Formation
Vein G
X2

Figure C-3

Bedrock Geology

▤ Goldenville Formation

▥ Devonian Granite   outcrops only

▨ Halifax Formation

Strike of beds (tops known, unknown)

Joints

Foliation; cleavage or flow line (granite)

Synclinal axis

Anticlinal axis

Fault (defined, assumed)

Contacts (assumed, approximate, defined)

Base Map compiled by Forest Management Institute, 1973

Redrafted by Eastern Ecological Research Ltd., 1975

Kejimkujik National Park

Parks Canada   Atlantic Region

Miles 1 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

Yards 1000 0 1000 2000 3000 4000   1:100,000

N

greatest pressure." (Lang and Cumming, no date.) The mica flakes introduce lines of weakness which allow the slate to cleave other than along the original bedding planes.

2. The Granites

Within the Park, the effect of this massive intrusion of granite can easily be seen. Looking across Kejimkujik Lake from the eastern shore, one observes the huge rounded dome on the western shore which is very different in physiography and other properties from the slates or quartzites.

Several areas of outcrop exist in the Park, the most extensive of these being near Mount Tom Lake where the jointing in the granite controls the drainage pattern (see Cumming, 1979 and Figure C-3 for other areas of outcrop). The granite dome forms the highest elevations of the Southern Uplands within the Park, and dominates the western half. In addition, granite boulders of varying sizes were part of the glacial drift, and their presence southeast of the batholith has greatly affected the landscape of the Meguma rock as well.

Granite is composed of varying amounts of quartz, feldspar, and mica. The quartz can be clear or milky; the feldspar can be white, grey or pinkish; the mica is usually black and shiny. There are many variations within the granites due to the presence or absence of various mineral substances. In addition, the size of the crystals varies according to how fast the granite cooled. At Kejimkujik they cooled slowly underground, resulting in fairly large crystals.

3. Migmatite

Migmatite is a rock which Cumming (1979) describes as "half granite and half altered sediment". He indicates that although no solid contact of the granites with the older Meguma rocks can be seen in place, some areas in the Park show the complexity of this contact (Figure C-3). The boulders in these areas are migmatites.

Mineral Occurrences:

Gold

The name Meguma is synonymous with "gold-bearing" rock in southwestern Nova Scotia. As mentioned previously, the Meguma rocks were folded into a series of synclines and anticlines, trending more or less parallel with the Atlantic Ocean (NE - SW) during the Acadian Orogeny. Practically all the gold-bearing veins in Nova Scotia are found at the domes of these folds, where they occupy the fractures in the rock caused by folding.

Gold, in any significant concentrations, is found in two ways. The first, "placer" gold, is the result of water eroding gold-bearing rocks and depositing the gold particles amid other sediments. The second, "reef" gold, is found in quartz rocks, often along with iron pyrites and arsenopyrites.

At Kejimkujik there is evidence of both types of deposit, but the most common is reef gold occurring in quartz veins found at the domes of the anticlines. The gold is thought to have been intruded in the quartz veins during the heating of the rock during the Orogeny.

> If the rocks came under the influence of temperatures and pressures great enough to fuse the sediments and form a granite then gold was apparently expelled from these hot areas.
>
> Cumming, 1979

Under these circumstances the only available place for the gold to be extruded was into the fractures on the domes of the anticlines.

There were two major gold mining areas in the vicinity of the Park, one at Whiteburn, the other the West Caledonia Gold District. Three mines were located within the Park itself, and were part of the now-abandoned West Caledonia district. The location of these mines is shown on page N-8 of "Past and Present Land Use" section. Cumming's (1979) report details the exploration, mining of gold, and the final collapse of the "gold boom" due to the difficulty of extracting the mineral and the small yield for a relatively large amount of work.

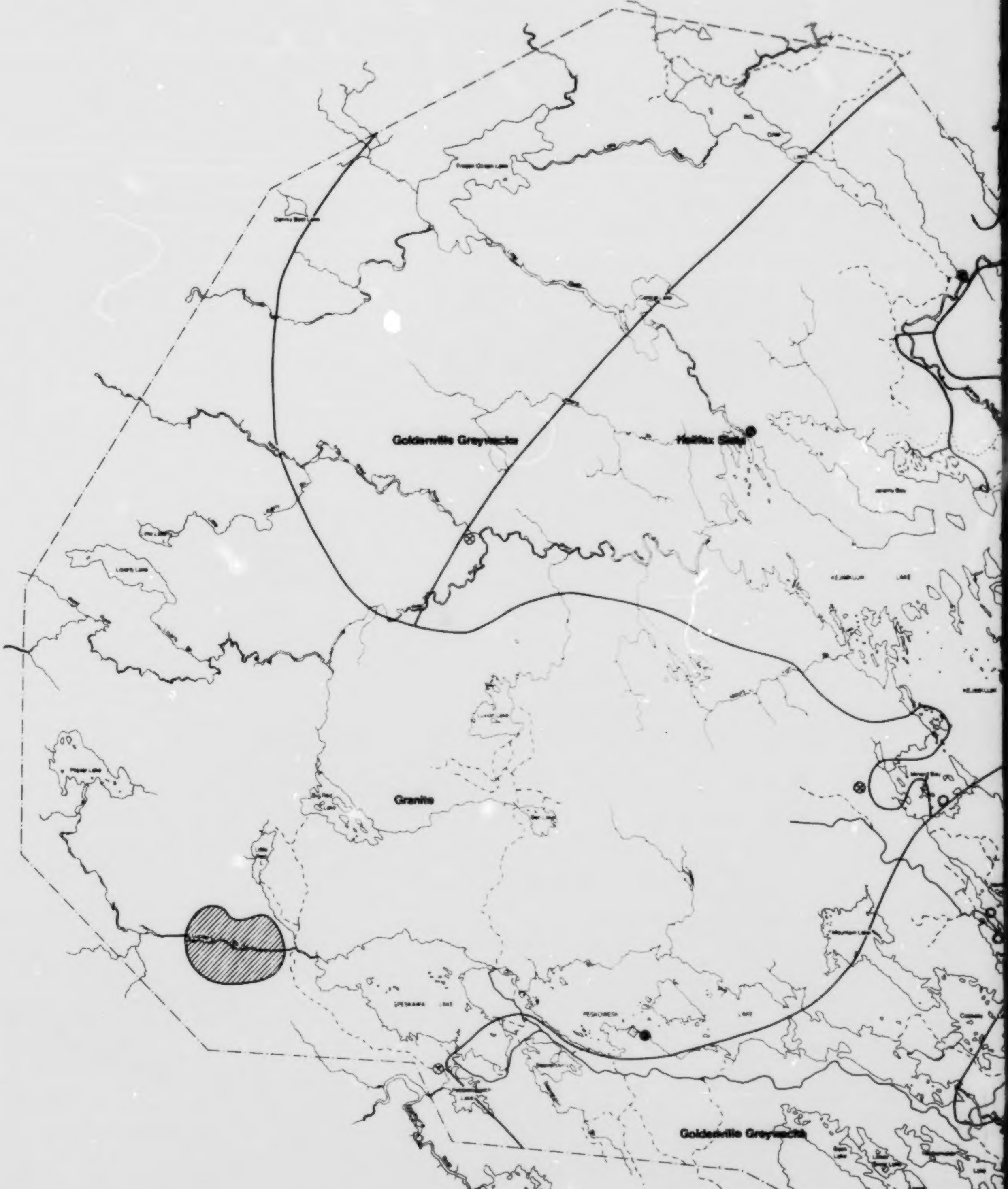
Other Minerals

The quartz veins which carry gold also carry arsenopyrite, pyrite and galena. Gleeson (1972) has detailed the relationships of these minerals from occurrences in streams and lake sediments. Gleeson (1972) further states that there is a direct relationship between high arsenic and iron values. Iron hydroxides trap or "fix" much of the arsenic which would otherwise remain soluble, and a possible threat to living things. Gleeson's (1972) report and the 1976 Resource Atlas give detailed accounts on areas with high concentrations of arsenic. Jones (1964) surveyed the Park area and listed the following mineral occurrences (Fig. C-4):

Arsenopyrite - McGinty Lake - crystals up to 6.35 mm in length.
Andalusite - widespread in schists of Halifax formation but especially in association with staurolite near junction of West and Northwest Rivers.
Feldspar - in granite - very large crystals in Minard Bay.
Galena - west of McGinty Lake, especially in old mine dumps.
Garnet - small crystals near Goldenville Formation.
Hematite - see p. 26 of Resource Atlas, 1976.
Hornblende - Pebbleloggitch Lake - in muscovite granites.
Pyrite - Peter Point, Kejimkujik Lake - crystals up to 12.7 mm in length.
Pentlandite - in drill cores at Kedge Lodge.
Sphalerite - McGinty Lake - in quartz veins which carry gold.
Tourmaline - Minard Bay, Kejimkujik Lake - in vein quartz.

Fossils

Fossils from the Meguma group are rare, indicating a period of time during their deposition which was not very favourable to living things (Bujak, Donahoe, 1980). However, Cumming (1979) found a valuable fossil locality containing graptolites and an annelid marking in the slates just outside the Park at Maitland Bridge.


Goldenville Greywacke
Halifax Slate
Granite
Goldenville Greywacke

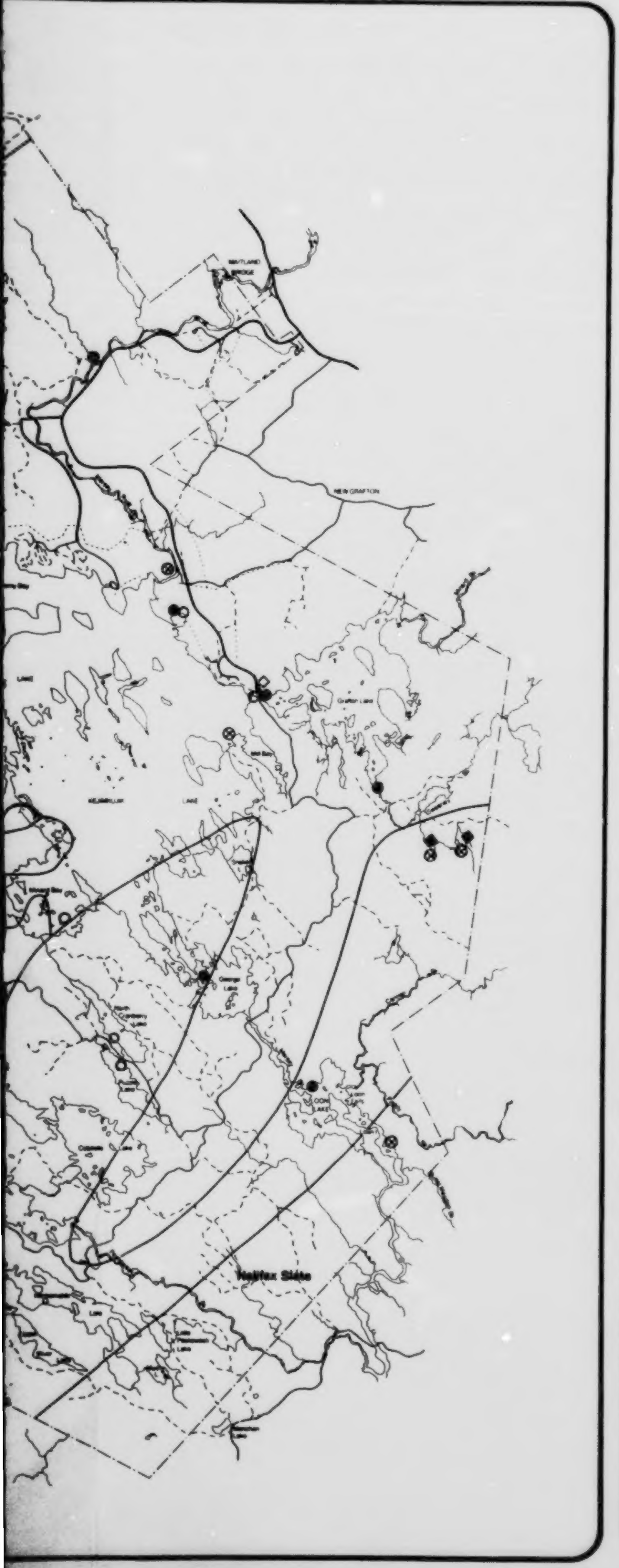

MAITLAND BRIDGE
NEW GRAFTON
Grafton Lake
KEJIMKUJIK
LAKE
Halifax Slate

Figure C-4

Mineral Occurrences
Geochemical Survey

- ◆ Known sources of Arsenic (gold bearing quartz vein)
- ● Iron Manganese Hydroxides fixing Arsenic and other metals (Nickel, Zinc, Cadmium)
- ○ Occurrences of combinations of Lead, Mercury and Cadmium
- ◇ Uranium with Iron and Manganese and other minerals
- ⊗ Mineral Occurrences; Jones 1964
- ▨ Meguma Group inclusion in Granite many aplite dykes

Base Map compiled by Forest Management Institute, 1973

Redrafted by Eastern Ecological Research Ltd., 1975

Kejimkujik National Park

Parks Canada Atlantic Region

Miles 1 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

Yards 1000 0 1000 2000 3000 4000 1:100,000

Graptolites are free-floating colonial marine organisms with individuals living in small cups along threadlike branches. These abound in some laminated Ordovician black shales; their fragile structures were not destroyed in the quiet and rather sterile environment of the clay deposition. Being free-floating, many of the same genera and similar species may be found over the whole earth. The appearance of these life forms is in consistent order whether they are found in Britain, North Africa or Australia, allowing a confident correlation with the black shales of Ordovician times (Cumming, unpub. man., 1982).

In the Goldenville Formation fossils are not known with the exception of Scolithus (a wormlike organism) tubes. Taylor (1969) described these structures from an island in Lake Rossignol to the south of Kejimkujik (Resource Atlas, 1976).

Bedrock Geology and its Effects on the Park Today:

Most of the more visible landforms seen in the Park are a direct result of the Pleistocene glaciation (which started approximately 100,000 to 80,000 years ago). Drumlins, shallow lakes, streams and rivers, and granite boulders are all the result of glacial action. However, the action of the ice sheets was in turn greatly influenced by the bedrock beneath it. Most of the lakes in the Park occur in the Meguma areas (Fig. C-3). Here the rock was soft enough, or had previously eroded enough so that the moving ice could gouge out shallow basins which later filled with water. Similarly, fewer lakes exist in the granite regions because they did not yield as well to the pressure of the advancing ice.

The many boulders found throughout the Park were formed before the first Pleistocene glaciation, which simply moved the boulders to their present locations. These erratics are a product of weathering and erosion of the intrusive granite mass.

Evaluation:

Management Objectives:

1. To further define and describe the bedrock geology of Kejimkujik National Park to permit understanding of surficial formations, soil and hydrological systems.

2. To examine and evaluate the bedrock geology of Kejimkujik in order to permit analysis of the processes which resulted in the creation of the land base now comprising Nova Scotia.

Resource Management Concerns:

The Halifax slate outcrops which feature petroglyph images are quite soft. While natural erosion continues, a greater hazard to the petroglyphs is ongoing impact caused by visitors scratching their own messages in the rock surfaces. Similarly, undirected pedestrian traffic will result in rock surface damage. Visitation to the petroglyph outcrops should be controlled to ensure impact is minimized.

Opportunities:

The various bedrock outcrops in Kejimkujik offer the opportunity for interpretation of the Acadian Orogeny, glaciation, petroglyphs and the gold-bearing Meguma formations. Ordovician shales, underlying the eastern portion of the Park, provide an indication of evolutionary linkages around the earth during ancient times.

Limitations:

It has been determined (Kerekes, pers. comm.) that when slate bedrock is significantly disturbed (e.g. by construction and road building) there is considerable ferrous sulphate erosion. This results in acidification of run-off to levels which can be lethal to fish. This same ferrous sulphate erosion can cause damage to petroglyph images found along the eastern shores of Kejimkujik Lake.

Glossary of Terms:

Geological Processes

anatexis	During a period of heat and pressure rocks already existing in the crust or mantle become a liquid; after cooling the new rock is an igneous form of previous rocks.
anticline	A fold or arch of rock strata dipping downward in opposite directions from the axis.
argillaceous	Pertaining to a rock that has considerable clay.
batholith	A large, generally discordant plutonic mass that has more than 100 km^2 of surface exposure and no known floor.
conformable	Designating beds, or strata, that lie upon one another in an unbroken and parallel order.
facies	Rock features reflecting the environment in which the rock was formed.
glacial drift	A term applied to all rock material transported by a glacier and deposited directly from the ice through melting.
igneous	Rock formed by cooling and solidification of hot, mobile mineral material called magma.

intrusive	Rock consolidated from magma beneath the earth's surface.
jointing	A fracture in a rock formation along which there is no evidence of displacement, i.e. folding, faulting, etc.
magma	Hot fluid rock material generated within the earth and capable of intrusion (below the surface) or extrusion (above the surface). When cooled and solidified it forms igneous rocks.
metamorphic	A rock that has been changed in texture and/or composition by heat, pressure, or chemically active solutions.
orogeny	The process of folding and faulting that results in the formation of mountain ranges.
pluton	A great body of intrusive igneous rock that formed beneath the surface by the cooling and consolidation of magma.
sedimentary	Rocks formed from sediments that were deposited by erosion.
slatey cleavage	In rocks, splitting along closely spaced parallel planes.
siliceous	Pertaining to rocks with a great deal of silica (sand).
syncline	A downfold or trough in which the strata dip inward from both sides toward the axis. The opposite of an anticline.

Selected Rocks and Minerals

arsenopyrite	The principal ore of arsenic; a combination of iron, arsenic and sulphur, it occurs in crystalline rock.
biotite	Black mica. A common ferromagnesian silicate material with one perfect cleavage yielding very thin, translucent, flexible sheets or scales.
feldspars	A group of minerals classed as aluminosilicates.
galena	The principal ore of lead.
garnet	A semi-precious stone which is a complex crystal formed of a group of minerals.
granodiorite	A rock closely resembling granite in look and texture. Orthoclase or microline and one of the plagioclase feldspars may be present, as well as quartz, biotite, hornblende, and augite.
greywacke (graywacke)	A grey, elastic sedimentary rock composed of fragmental granite debris and other rock and mineral fragments in a muddy matrix.
gneiss	Close-grained imperfectly foliated feldspathic rock, usually metamorphic. (High grade.)
hematite	The principal ore of iron.
hornblende	A dark, aluminous mineral.

mica	White mica, a member of the mica group of minerals.
pentlandite	The principal ore of nickel.
porphyritic	Designating a rock texture in which large phenocrysts (crystals) are set in a finer groundmass.
pyrite	A brass-yellow mineral composed of iron sulfide. It has cubic crystals and is commonly striated. Popularly called fool's gold.
pyrrhotite	Often associated with pentlandite, an ore of nickel.
quartz	A mineral composed of silicon dioxide with six-sided crystals tapering to pyramids at the ends. Colourless or white when pure, but commonly tinted. Without cleavage.
quartzite	A re-crystallized (from sandstone) metamorphic rock consisting mainly of quartz.
schist	Metamorphic rock which has a foliated (laminated structure) structure. Mica is prominent.
slate	A compact, fine-grained metamorphic rock that can be split into slabs and/or thin plates.
sphalerite	An ore of zinc, often associated with galena.
tourmaline	A complex group of minerals usually found in crystal form.

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GEOMORPHOLOGY

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Overview:

Kejimkujik National Park is located on the Southern Upland of Nova Scotia. This area is basically a flat plain lacking the major escarpments, mountains and valleys found in other parts of the province. However, the Park contains examples of many smaller surface features created during the Wisconsinan glacial stage.

Giant boulders, boulder fields, long winding eskers and drumlin hills are easily observed while kames and outwash plains are less obvious and relatively inaccessible. Following glaciation, the formation of numerous shallow lakes connected by wandering rivers has made southwestern Nova Scotia the best canoeing country in the province.

Glacial History:

During the Wisconsinan glacial stage of the Pleistocene Epoch, the Laurentide ice sheet covered most of Canada east of the Rockies, and also the northeastern United States as far south as Cape Cod. However, recent studies by Grant (1977, 1980) suggest that Atlantic Canada was not glaciated by the Laurentide ice sheet, but by ice from local ice centres (Figure D-1). Thus, while most of Canada was carved by a relatively simple, unidirectional flow of ice, Nova Scotia was attacked by four separate glacial pulses of varying origin, direction of flow, and strength. In order of occurrence, the four glacial pulses, together with two warmer interglacial periods, are as follows:

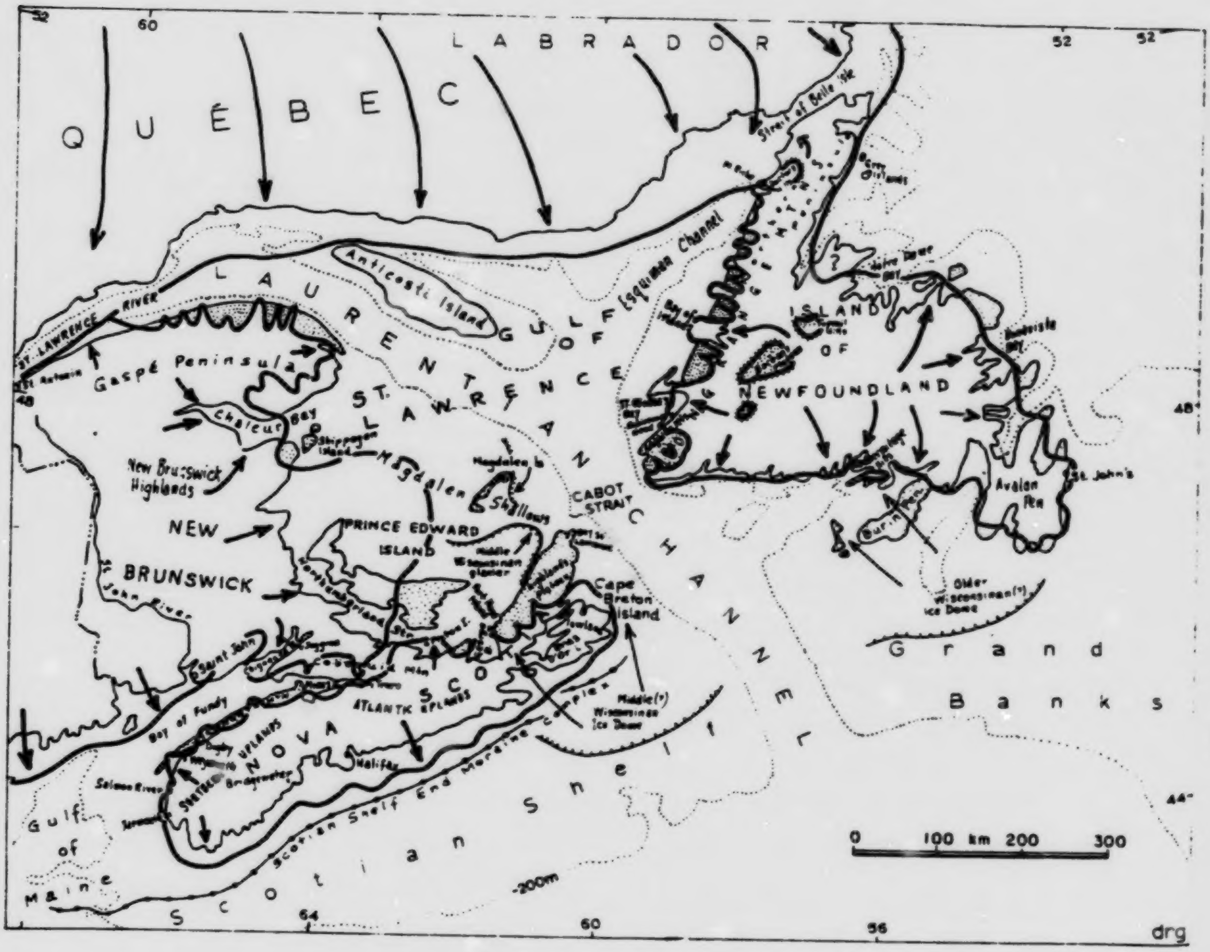

LABRADOR
QUÉBEC
Strait of Belle Isle
ST. LAWRENCE RIVER
LAURENTIAN CHANNEL
Anticosti Island
GULF OF ST. LAWRENCE
Esquiman Channel
Gaspé Peninsula
Chaleur Bay
Shippegan Island
New Brunswick Highlands
NEW BRUNSWICK
Saint John River
Magdalen Is
Magdalen Shallows
PRINCE EDWARD ISLAND
Middle Wisconsinan glacier
CABOT STRAIT
Cape Breton Island
Middle (?) Wisconsinan Ice Dome
ISLAND OF NEWFOUNDLAND
Avalon Pen
St. John's
Burin Pen
Older Wisconsinan (?) Ice Dome
Grand Banks
Bay of Fundy
NOVA SCOTIA
ATLANTIC UPLANDS
Halifax
Scotian Shelf End Moraine Complex
Scotian Shelf
Gulf of Maine
-200m
0 100 km 200 300
60
52
48
44
64
56
drg

Figure D-1 Hypothetical extent of glacial ice during the latest major expansion about 25,000 - 15,000 years ago. Atlantic Canada is shown under the influence of local ice centres independent of Laurentide ice sheet (from Grant, 1977).

1. Early Fundy Stade

Began 100,000 years ago with a westward spread of ice from ice caps over Nova Scotia's uplands.

2. Late Fundy Stade

An overriding flow of ice from the New Brunswick ice complex moved southwards over Nova Scotia and out onto the coastal shelf, the strongest glacial advance.

3. Clare Interstade

Glaciers disappeared from all of Nova Scotia about 50,000 or more years ago; this warm period lasted for about 15,000 years (Roland, 1982).

4. Digby Stade

Again, a spread of ice from ice caps over Nova Scotia's uplands.

5. St. Mary Interstade

Ice retreated only enough to expose the coastal regions of Nova Scotia.

6. Scotian Stade

Began about 25,000 years ago; a weak advance of upland ice extending only slightly beyond the present coast, leaving parts of North Mountain and large areas of emerged shelf as potential biological refugia; duration 10,000 years.

For almost 90,000 years, Nova Scotia lay beneath the ice. The glaciers disappeared 10,000 to 12,000 years ago, leaving behind the soils and landforms seen today.

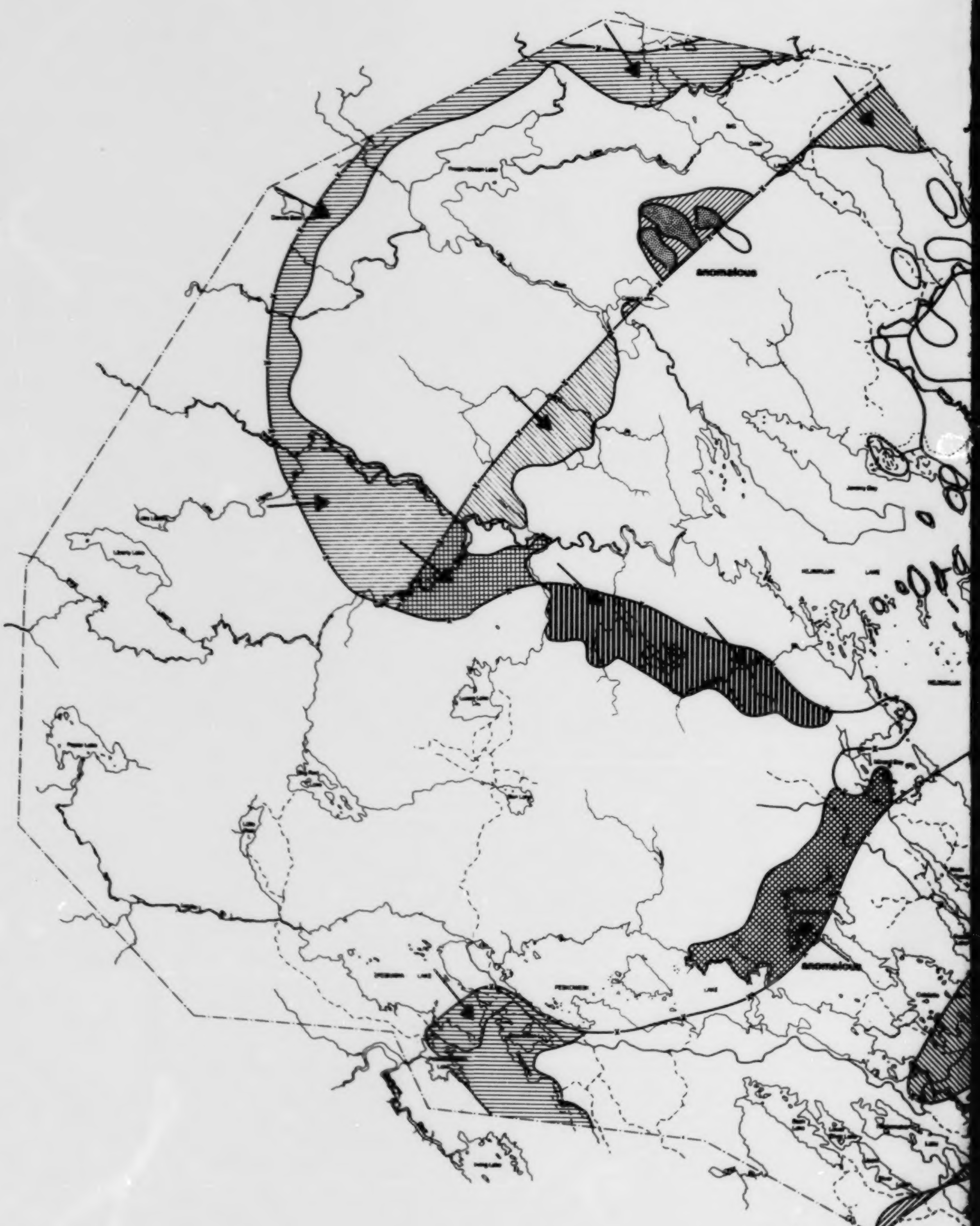
Tills:

The till material overlying the bedrock of the Southern Upland is generally rocky and thin. It varies considerably in thickness, ranging from less than 2.5 cm to 25 metres or more in depth at the site of a drumlin. Although large expanses of bare bedrock can be found on the Southern Upland, only smaller outcrops occur in the Park.

The surface till corresponds closely with, and is derived mainly from the underlying bedrock. However, the movement of ice over the land has given rise to various tills being deposited over different bedrock types (Fig. D-2).

The occurrence of four separate glacial pulses in Nova Scotia resulted in the deposition of four layers of till, each differing in colour, texture and origin (Stea and Grant, 1982). The surface till, covering the whole of the Southern Upland, is a relatively thin layer of coarse, angular rock fragments, averaging only two or three metres thick. This layer is the result of the final, weak advance of a thin ice sheet which did relatively little grinding.

Beneath this surface layer, particularly in the thicker deposits, are older, fine-textured tills deposited by earlier glaciation. Some of these older tills were derived from local rock and deposited by thick ice spreading from


anomalous
anomalous

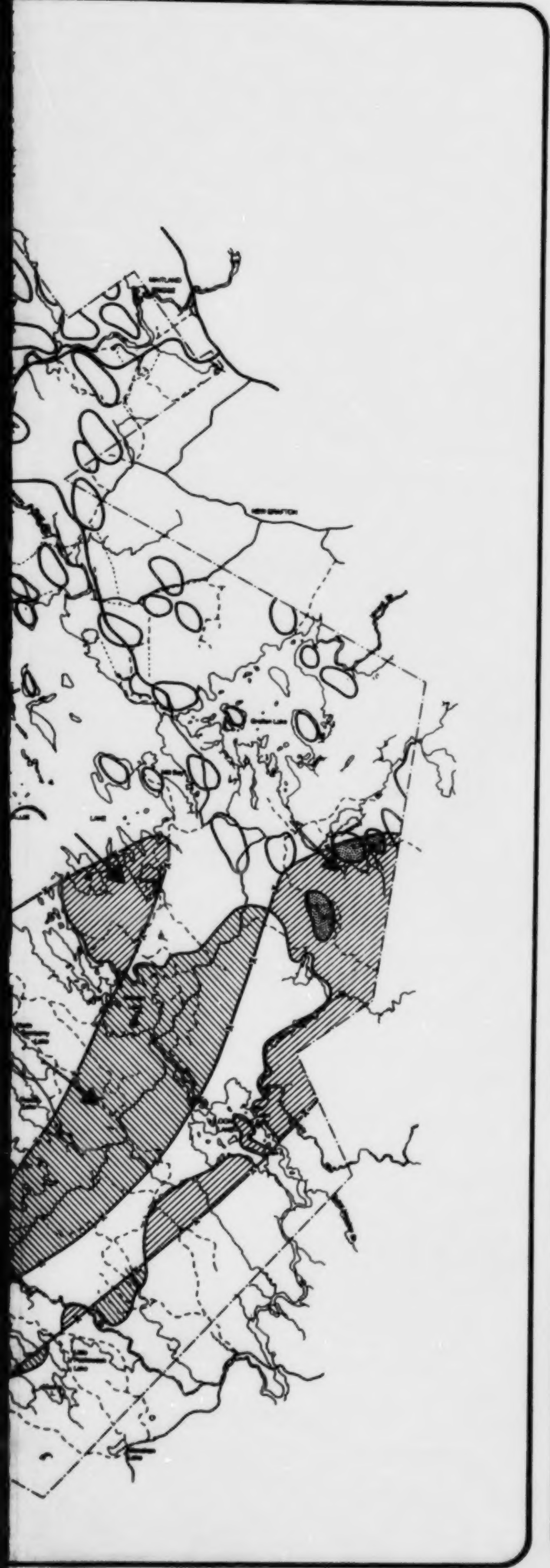


Figure D-2

Relationships of Bedrock Outcrops to Glacial Tills

⬭ Drumlins (Bridgewater Till)

➔ Inferred directions of movement

—x— Geological Bedrock Contacts

—— Glacial Till Contacts

▧ Halifax Till over Halifax Slate

▩ Halifax Till over Granite (anomalous)

☰ Gibraltar Till over Goldenville Greywacke

▦ Gibraltar Till over Halifax Slate

▥ Bridgewater Till over Granite

▨ Bridgewater Till over Goldenville Greywacke

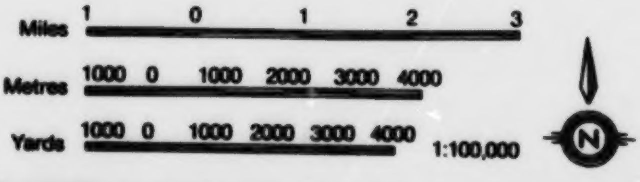
░ Bridgewater Drumlins over Goldenville Greywacke

Base Map compiled by Forest Management Institute, 1973

Redrafted by Eastern Ecological Research Ltd., 1975

Kejimkujik National Park

Parks Canada Atlantic Region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local ice centres in Nova Scotia. The fine-grained, red-brown till found in drumlins east of the Park was derived from the marine muds of the Bay of Fundy and was deposited here by the flood of ice from New Brunswick (Prest and Grant, 1969).

Glacial Landforms:

Glacial ice creates landforms in two ways: by erosion and by deposition.

Erosion begins with the removal of loose soils, exposing the bedrock to the grinding action at the base of the ice. The relatively soft slates of Kejimkujik are etched, grooved and smoothed by the moving ice. In granite and quartzite areas, large blocks of these harder rocks are removed along joint planes, helping form rock basins for future lakes. These events did little to change the generally flat nature of the Southern Upland. The most obvious landforms created by glaciation arise not from erosion but from deposition.

There are two main types of glacial deposits:

1. landforms created directly by the action of the glacier (drumlins, moraines, boulder fields); and

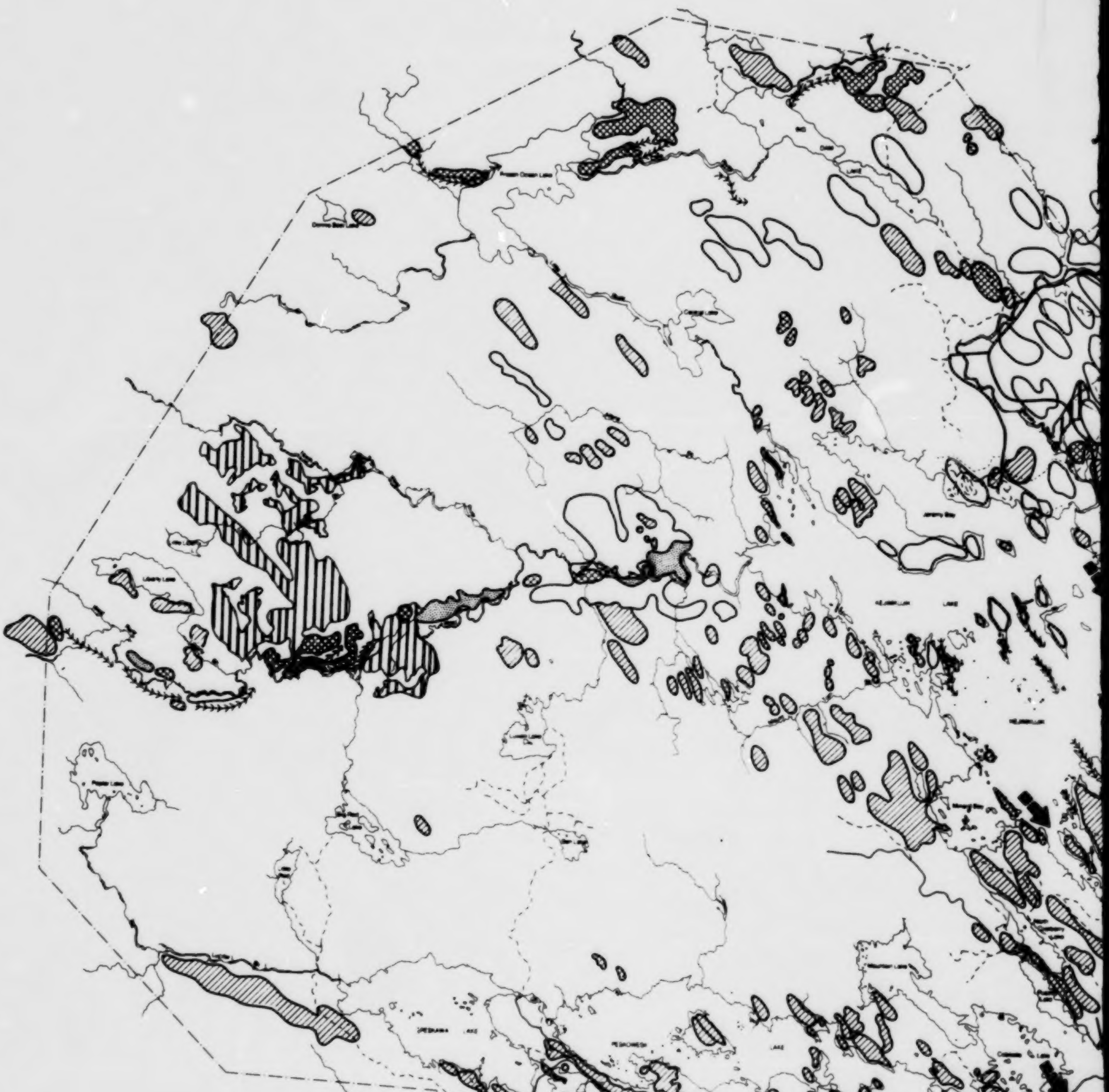
2. landforms created by meltwater issuing from the glacier (eskers, kames, outwash plains).

Not all landforms observed in Kejimkujik fit the classical shape and theory of origin. Irregularly-shaped drumlins grade into moraines, and kames can resemble hummocky outwash plains. Similarly there is often no sharp visible distinction between landforms created directly by a glacier and those formed partially by meltwater. In addition, the landforms created during early Wisconsinan glaciation were later modified by ice advances of different intensities and directions. Thus, glacial landforms found in the Park have been classified differently by various researchers. Figure D-2 (Eastern Ecological Research Limited, 1976) shows the location and classification of glacial features.

a) Drumlins

Drumlins are smooth, oval hills which have a steeper, blunt end facing the oncoming glacier, and a gentle slope pointing in the direction of ice movement. They were formed when a large accumulation of eroded material was deposited underneath the ice. The glacier then continued to move up and over this material, moulding it into the streamlined drumlin shape.

Because slate is softer and more easily eroded by the glacier, drumlins are more numerous in areas underlain by slate bedrock, where they occur in swarms rather than as isolated hills. This association with slate is clearly shown at Kejimkujik. The drumlins occur mainly in the eastern portion of the Park over slate bedrock. These drumlins comprise the northwestern edge of a large drumlin swarm centred in Lunenburg County. The drumlins in the Park all trend southeastwards, indicating the direction of the strongest ice advance across southwestern Nova Scotia (Fig. D-3).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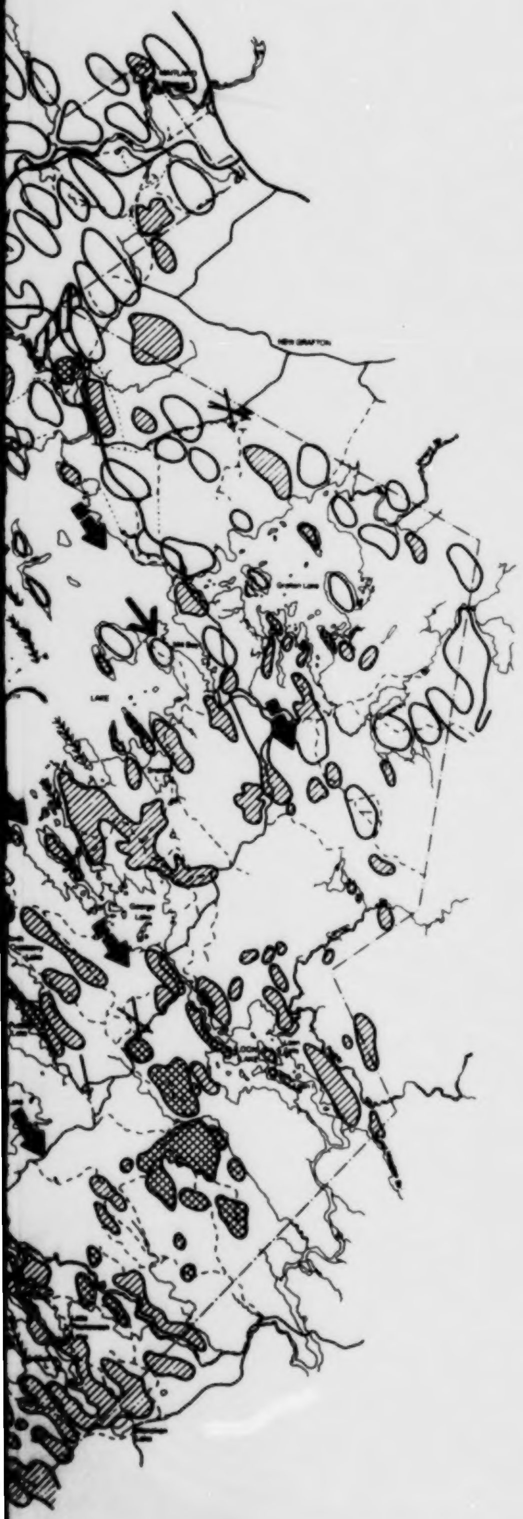

Figure D-3

Glacial Features

- ◌ Drumlin and Moraine
- ○ Drumlin and Moraine*
- ▨ Kame
- ▒ Delta
- ☒ Esker
- ▥ Kames, Deltas, Eskers*
- → Striations

Kame, Delta, Esker: fluvio-glacial deposits

➡ Jones: 1964 → Taylor: 1969

*indicated on N.S. Soil Survey

Base map compiled by Forest Management Institute, 1973

Redrafted by Eastern Ecological Research Ltd., 1975

Kejimkujik National Park

Parks Canada Atlantic Region

Miles 1 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

Yards 1000 0 1000 2000 3000 4000

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The rolling landscape east of Kejimkujik Lake contrasts sharply with the relatively flat granite area in the western portion of the Park. The fairly rich, deep and drier soils found on drumlins encourages the growth of hardwood forests, adding to the variety of vegetation and wildlife in the Park.

b) Moraines

Mounds or ridges which lack the streamlined shape of a drumlin are called moraines, or simply "drift mounds". They were formed when the glacier stopped advancing and material was dumped or released vertically as the glacier started to melt. Moraines are usually composed of loose, coarse till, the finer sediment having been removed by the meltwater. The resulting landscape consists of numerous small hills of irregular shape. This topography occurs along the southern margin of the Park and along the western edge of Kejimkujik Lake.

c) Granite Boulders

Large granite boulders, sometimes weighing more than 1,000 tons, were dropped by the retreating glacier onto the surface of the till. Such immense boulders become minor landforms in their own right. When till is carried on to bedrock of a different type it is termed erratic. Many erratic boulders occur in the eastern portion of the Park where the underlying bedrock is slate or quartzite.

Both granite and quartzite are jointed bedrock types found commonly in Kejimkujik National Park. As the glaciers flowed over this jointed bedrock, large blocks of rock became frozen into the base of the ice. These were then plucked from the bedrock to be dropped some distance from their origin. Most of the boulders in the Park have likely come only short distances from the granite area to the north. However, some have no doubt travelled from greater distances (Bailey, 1896).

Giant boulders can be observed west of Kejimkujik Lake. Relatively accessible examples occur at Poison Ivy Falls between Peskawa and Peskowesk Lakes, in Kejimkujik Lake between Big Muise and Little Muise Islands, and near Frozen Ocean Lake. In addition, most drumlins and lake shores are dotted with granite boulders one to two metres in diameter.

d) Eskers

Eskers are long, sinuous ridges lying roughly parallel to the direction of former ice flow. They were formed by the deposition of material in an ice tunnel carved at the base of a glacier by meltwater streams flowing over the bedrock.

Several islands in Kejimkujik Lake are short segments of eskers. Much longer eskers occur along the northern margin of the Park and also along the upper portion of West River.

The orientation of eskers in southwestern Nova Scotia, radiating outwards from Kejimkujik Lake, suggests that this was the site of a remnant ice cap at the end of the Wisconsinan glaciation.

e) Kames

Low, irregular mounds of fine sand, gravel and cobble, occurring singly or in clusters, are called kames. They were formed when material washed into pools or holes in the ice, or into ponds at the edge of a glacier. Kames occur along the northern margin of the Park, along West River, and also southwest of Loon Lake. One small, readily accessible kame can be reached by canoeists a short distance upriver from Jakes Landing.

Sometimes, material was washed into a crevasse or a deep crack in stagnant ice. Instead of a low mound of material, the result was a short, straight ridge lying parallel to the ice front. Roland (1982) has suggested that the short projections on Ell and Little Muise Islands in Kejimkujik Lake are examples of such crevasse fillings.

f) Outwash Plains

Low, flat plains of sand or gravel were formed as streams, issuing from the front of stagnant or retreating glaciers, deposited material into temporary glacial lakes lying beyond the edge of the glacier. Similarly, as the meltwater of such streams slows down, sediments may be deposited in a series of alluvial fans over the land itself, to form a broad plain.

Outwash plains are more common elsewhere in Nova Scotia where glacial meltwater flowed through mountain passes, between hills, or down the larger river valleys. In the

Park, they can be found along and north of West River as well as along Lucifer Brook (Stea and Grant, 1982).

g) Rivers and Lakes

The glacial deposition of drumlins, moraines, eskers and kames has completely altered the original drainage patterns in southwestern Nova Scotia. Old river valleys have been buried. Glacial deposits act as dams to retain water in rock basins and depressions, forming numerous relatively shallow lakes where there were few or none prior to glaciation. Rivers wander from lake to lake, partly in old, well-established valleys, partly in new courses. The present rivers and lakes of Kejimkujik reflect the various geomorphic phenomena which contributed to their creation.

Management Objectives:

1. To preserve representative geomorphological features such as eskers, drumlins, kames and floodplains while permitting non-consumptive recreational use.

2. To continue inventory and analysis of geomorphological features in the Park to eliminate deficiencies in the data base.

Research Requirements:

There appears to be a requirement for further analysis of geomorphological features in the more remote western portion of Kejimkujik National Park. Similarly, further knowledge may be gained about till origin and deposition should excavation of glacial landforms occur as a result of construction activities.

Opportunities:

The varied and highly visible geomorphology of Kejimkujik National Park provides many potential opportunities for interpretation of glacial activity and its results. Similarly, the relationship between drumlins and their associated vegetation and wildlife offers interpretive potential.

The geomorphology of Kejimkujik also offers the opportunity to test the accuracy and effectiveness of aircraft and satellite-borne remote multi-sensing systems.

Limitations:

The geomorphology of Kejimkujik offers relatively few restrictions to recreational use. The presence of boggy areas in some locations can make trail and road development difficult. However, alternate routeways over drier ground can often be found.

The steep topography can result in significant potential for erosion in some locations if the ground cover vegetation is removed.

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SOILS

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Description:

Soil Formation:

After the melting of glacial ice in the Park area 10,000 years ago, soils began to form on the remaining cover of tills and fluvio-glacial deposits above the bedrock. All traces of former soils had been obliterated by glaciation.

Parent materials determine the mineral content and texture of the soil. Physical and chemical weathering changes rocks into unconsolidated parent material and then into its constituent particles. With time, further alteration of minerals and the formation of secondary clay minerals rely increasingly on chemical processes. Where resistant varieties such as quartz and orthoclase feldspar are dominant, the soil usually has a coarse texture. Where less resistant minerals are found, the process of physical and chemical change occurs more rapidly.

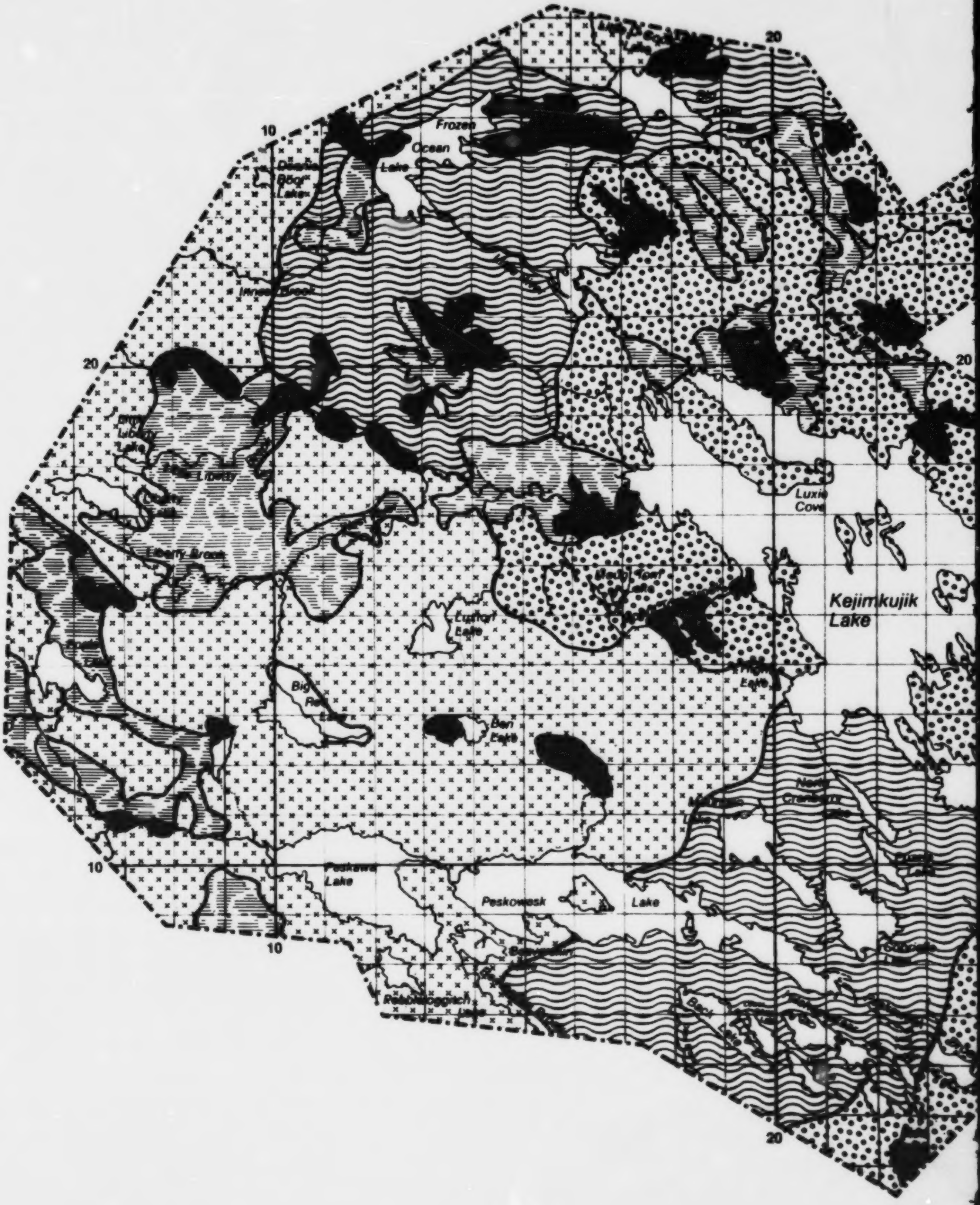
The climate of Kejimkujik National Park favours rapid leaching but slow replacement by weathering (Eastern Ecological Research, 1976). Organic matter tends to accumulate rapidly as the winters do not encourage rapid decomposition. The type of litter (organic debris) influences the leaching ability of the percolating water. Coniferous trees drop a litter which is largely unpalatable to micro-organisms and consequently decomposes slowly. Infiltrating water is rendered more acidic and is efficient in leaching out nutrients. Deciduous forests, on the other hand, favour micro-organisms which make nutrients available and open up the soil structure.

Precipitation, which is almost 76 mm in each month of the year (Eastern Ecological Research, 1976), encourages leaching. Where run-off is restricted and water tables are high, gleying (water logging) of the soil is found. The soils of Kejimkujik are classified according to the parent material they have been derived from, and the ability of the soil to drain off water.

Soil Types:

Because drainage is a key factor in developing the soil profile, the soil series listed in Table E-1 exhibit similar profiles even though the parent materials are quite dissimilar. The Bridgewater catena is derived from the glacial till whose principal component is the Halifax slate. Similarly, the Halifax catena is associated with the Goldenville graywacke and the Gibraltar catena with the granite. Torbrook and Nictaux soil series are developed on fluvio-glacial outwash deposits.

Referring to Table E-1 and Fig. E-1, in order to place the soils in the Nationwide System of Soil Classification for Canada (S.S.C.C., 1970), the order, great group and subgroup classifications are included. Three of the eight Canadian orders are represented in the Park: podzols, gleysols, and organics. Podzols are typical of cool, wet northern climate in which the predominant processes are removal of soluable salts and organic matter and clay from the upper layer and deposition in the lower layers. Gleysols form under reducing conditions which occur continuously or during some period of the year. Temperatures high enough to permit microbial activity and hence, depletion of oxygen, are essential to the gley process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Ocean
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Liberty
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Kejimkujik
Lake
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Cove
Big
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Ben
Lake
10
Peskawa
Lake
Peskowesk
Lake
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Back
Lake
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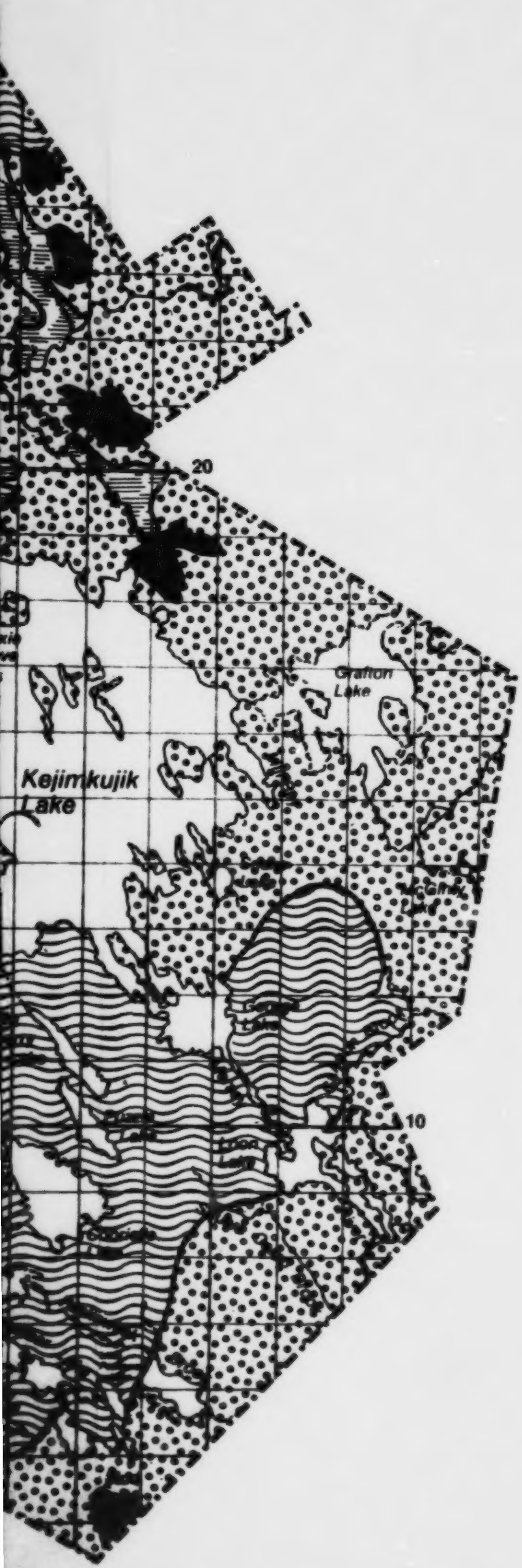
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Grafton Lake
Kejimkujik Lake
10

Figure E-2 Soils

⁙ Gibraltar (granite)

▒ Bridgewater (slate)

≋ Halifax (quartzite)

▤ Bayswater
Aspotogan
Middlewood
Nictaux

■ Peat

Kejimkujik National Park

Parks Canada Atlantic Region

Miles 1 0 1 2 3
Metres 1000 0 1000 2000 3000 4000
Yards 1000 0 1000 2000 3000 4000 1:100,000

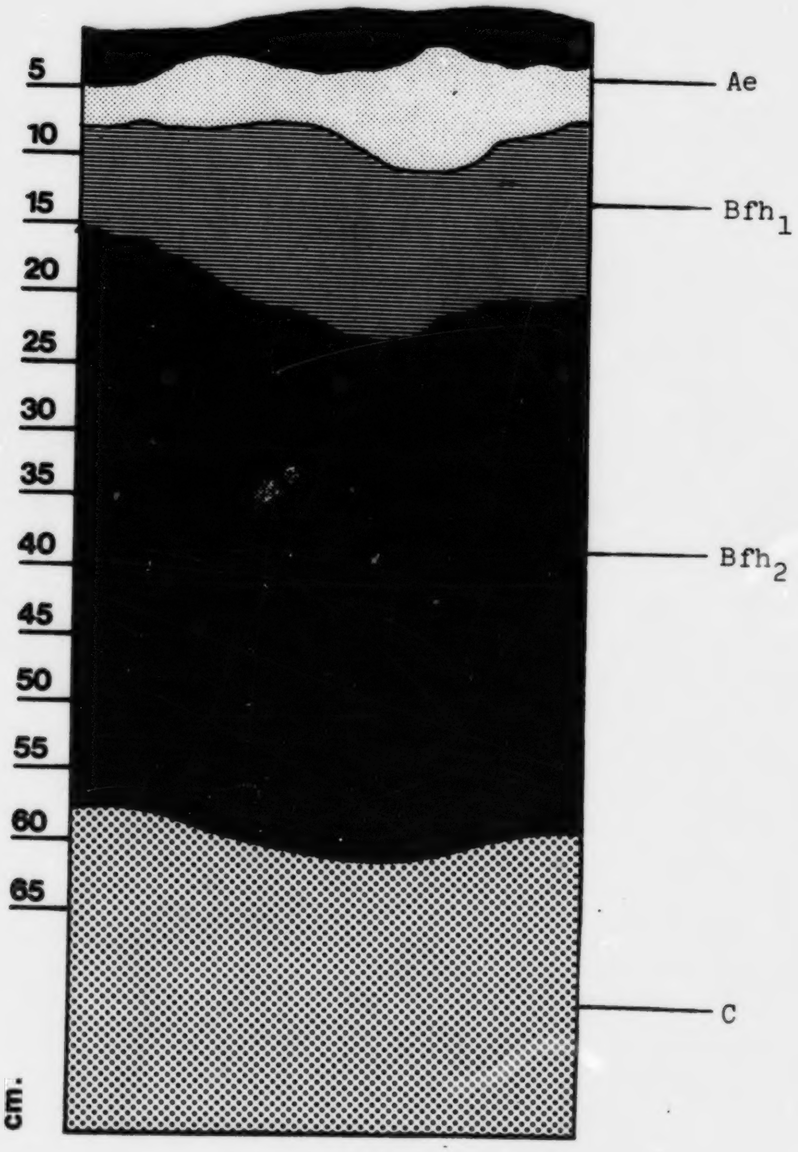
Table E-1 Classification of the Soils

Parent Materials		Podzols			Gleysols	Organic
		Orthic Humo-Ferric		Gleyed Humo-Ferric	Undifferentiated	
Texture	Colour	Rapid*	Well*	Imperfect*	Poor*	Poor*
silt loam/ loam	olive grey	-	Bridgewater	Riverport	Middlewood	
sandy loam	greyish-brown	-	Halifax	-	Aspotogan	
coarse sandy loam	pale brown	-	Gibraltar**	Bayswater	Aspotogan	
shaly sand & gravel	brown	Torbrook	-	-	-	
coarse sand & gravel	yellowish-brown	Nictaux	-	-	-	
semidecomposed organic material						Peat

*drainage classes
**these soils may also exhibit an ortstein layer

(from: MacDougall, Nowland and Hilchey, 1969)

Fig. E-1 Typical Soil Profile of a Virgin Podzol Nictaux Sandy Loam


5
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65
cm.
Ae
Bfh_1
Bfh_2
C

Source: MacDougall, Nowland and Hilchey, 1969

Fig. E-1 (cont.)

a) Humo-Ferric Podzol (Nictaux)

Horizon	Depth (cm)	
L-F-H	10-0	brown, semi-decomposed fibrous litter, H layer very thin and discontinuous
Ae	0-10	light grey, (10YR 7/2) sandy loam; weak granular; porous; loose; abrupt boundary; pH 4.2
Bfh1	10-25	strong-brown (7.5YR 5/8) sandy loam; weak; granular; porous, very friable; gradual boundary; pH 4.6
Bfh2	25-60	yellowish-red (5YR 4/6) sandy loam, structureless to weak; granular; porous; gradual boundary; pH 4.9
C	60+	coarse stratified sand and gravel; porous; friable

b) Gleysol (Aspotogan)

Horizon	Depth (cm)	
L-H	5-0	semi-decomposed layer of organic matter; greasy
Aheg	0-28	very dark grey (10YR 3/1) peaty loam; granular; abundant roots; permeable; clear boundary; mottled
Bg	28-76	olive-grey (5Y 5/2) gravelly sandy loam; single grain; slight cementation between 28 cm and 46 cm; permeable; mottled; saturated with water
Cg	76+	light olive-grey (5Y 6/2) sandy loam; cobbly and stony

(C.S.S.C., 1978). Colours of these soils are comparatively dull and mottles are predominant, although mottles may be lacking in permanently saturated horizons.

Within the podzols of the Park only one great group is represented: the humo-ferric (Fig. E-1). These are podzols in which organic matter, iron, and aluminum are the main accumulation products in the "B" horizon. The humo-ferric podzols developed under mixed and coniferous forest cover over various climatic conditions, but they are dominant on the well-drained sites in moist, cool regions on coarse non-calcareous materials (C.S.S.C., 1978).

This great group is divided into two sub-groups within the Park: the orthic humo-ferric and the gleyed humo-ferric. Orthic humo-ferric podzols in Kejimkujik National Park exhibit both an organic layer and an "A" horizon thicker than 25 mm. Clay accumulations are predominant just below the Ae horizon and are associated with the horizon containing the greatest organic matter and sesquioxide accumulations. Gleyed humo-ferric podzols have the general characteristics of humo-ferric podzols but with mottling and duller colours due to periodic wetness (Eastern Ecological Research, 1976).

Soil-Vegetation Relationships:

Referring to Fig. E-2, the difference in parent material and drainage categories can result in some very dramatic differences in vegetation in Kejimkujik, and elsewhere. For example, some drumlins in Kejimkujik formed over the slates and have a greater proportion of slate tills. As a result, these tills weather to produce soils that have more clay minerals. Thus trees and other vegetation requiring a fair degree of these nutrients tend to grow on the drumlins. These are largely the hardwoods, and the depth of the till allowed these trees to develop the deep roots which are capable of retrieving clay minerals which could otherwise be lost by leaching. In addition, humus from these types of plants is high in nutrients. The well-aerated soils on the tops of the drumlins are also beneficial for soil organisms. As a result of all of these interactions, a deep, fairly rich topsoil has developed under the canopy of hardwoods on the tops of the drumlins. This phenomenon was to affect the settlement and farming patterns in the Kejimkujik area. An example of these soils can be found among the hardwoods on the Beech Grove Trail.

On the other hand, without the addition of this rich humus and associated clay minerals, the process of leaching is very rapid. On top of the drumlin on the Old Farm Trail, the soils have been reduced to a sterile sand. Here, an old field is being overtaken by white pine, which requires little in the way of nutrients, and returns very little to the soil (Eyre, 1963).

The vegetation of the Park closely mirrors the underlying parent material and drainage patterns. The granite tills of the Gibraltar series have weathered to produce mostly quartzite, and few clay minerals. Less demanding softwoods, with their shallow root systems and acid, nutrient-poor litter, have tended to maintain, or possibly lower, the acidity and low productivity of these soils.

Soil-Hydrology Relationship:

Not only do the soils affect the land vegetation, but the water chemistry of lakes and rivers as well. Most of the water that fills these basins is run-off from the surrounding land. Brooks which drain through Bridgewater soils tend to be better buffered with higher pH values when compared with those which drain through the more acidic Halifax and Gibraltar soils. This variety of water quality characteristics influencing the major Park watersheds helps dictate the status of much of the aquatic biota found in Kejimkujik.

The impact of acid precipitation and poor soil management is potentially critical in the Kejimkujik area because soil and run-off water pH values tend to be low naturally. In such already marginal conditions, additional acidification could have significant effect on soil productivity in addition to other elements in the ecosystem. This circumstance makes the Kejimkujik area an important one for research into the long-range transport of air pollutants.

Evaluation:

Objectives:

1. To minimize erosion degradation and soil compaction through proper management of human activities, and appropriate design of facilities.

2. Recognizing the importance of soil quality as a basis for resource productivity, to ensure the natural processes and organisms which contribute to soil quality and productivity are maintained unimpaired.

Resource Management Concerns:

1. While the impact has not been fully researched at Kejimkujik, the potential exists for soil acidification caused by acid rain. This could affect the vegetation, and run-off water chemistry, to the detriment of aquatic life. Similarly, soil invertebrate populations could be affected, subsequently involving animal species higher in the trophic hierarchy.

2. Heavy human use of certain trails, brooks, and streambank areas during early springtime has caused vegetation cover destruction followed by soil erosion. This erosion may result in stream siltation, to the detriment of game fish spawning beds, and disruption of natural stream flow patterns over time. Care should be taken to manage visitor use pressure to prevent soil erosion and the associated detrimental effects.

Research Requirements:

1. Continuing research on the impact of environmental acidification on soil quality in southwestern Nova Scotia is required. The effects of this phenomenon could be having a detrimental impact on the productivity of ecosystems in Kejimkujik National Park.

2. With continued heavy use of Kejimkujik National Park, soil compaction and related impacts can damage regeneration potential and become an unsightly problem. Study is required to further define and quantify this impact on trail corridors, campsites and associated natural resources. Following this, refined management strategies should be implemented.

Opportunities:

The soils of Kejimkujik National Park offer an opportunity to interpret the geology and related dynamic forces which dictate the Park's vegetative cover, hydrology, and wildlife component. Research on the various soils of Kejimkujik could help expand the understanding of the impact of environmental acidification on the forest and aquatic ecosystems.

Limitations:

Because of the coarse texture, and rapid drainage, there are no major problems with compaction or limitations to construction on either the Gibraltar, Bridgewater or Halifax soils, other site limitations aside. Organic soils occurring in bogs, stream and lake edges tend to be unstable and may require protection from human impact. In addition, areas of fine-textured alluvial soils found on sites such as the Mersey River floodplain have severe limitations to construction.

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VEGETATION

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Description:

Origin of Vegetation Complex:

The present composition of Nova Scotia vegetation is comparatively recent but many of the genera and species of plants that compose it are very old. In early Tertiary times the land mass of Laurasia (North America, Europe and Africa) was possibly 30° to 40° further south than the continents are today and what is now northern Canada was covered with a mixed mesophytic forest. During the Tertiary period the land mass drifted northward, the continents separated, the climate became cooler and the rich, deciduous forests migrated south along the sides of the new continents. The hardier plants left behind form the present arctic and boreal floras. During this same period, the southeastern part of the United States became elevated and exposed the coastal margin, creating a new habitat for plants to colonize. Plants from Central America and from around the Gulf of Mexico moved northward along this coastal margin and formed an extensive vegetation adapted to bogs, swamps and coastal forests.

As the continents continued to drift northward, continental glaciers developed and in eastern North America flowed southward as far as southern Pennsylvania and New England, and approached the edge of the continental shelf. During four periods of glaciation alternating with warm interglacial periods, the plants migrated back and forth along the eastern seaboard--pushed south as the ice advanced and expanding northward as the ice retreated. One main result of these periods of glaciation is the great expansion of the evergreen forest in place of the mixed mesophytic forest. The conifers, birches, poplars and willows advanced more rapidly and occupied the shallow, poorly-drained soils formed by the glaciations.

At this time all of Nova Scotia and the coastal shelf as far as Sable Island were covered with ice. After it retreated about 13,000 to 14,000 years ago, plants migrated into the province by two possible routes: (1) into southwest Nova Scotia along the coastal plain from the southwest, or (2) through Maine and New Brunswick into northern Nova Scotia. The coastal plain route was the earlier one, along a landbridge of low bars and islands across the mouth of the Gulf of Maine and by way of Georges Bank into southwestern Nova Scotia. Many of the plants now common in the province may have migrated first by the landbridge and later by the northern route, with the two immigration waves then mingling together. Only when a species is confined to the southwestern area or the southwestern plant differs in some characteristic, is it assumed to have migrated by the southern route. Many of the coastal plain species in the province are very rare, being found in only one river system or in a few favorable habitats. The widely scattered locations for many of the rarer species suggest that the southwestern flora is a remnant of what originally formed a more widespread vegetation on the now submerged northern coastal plain.

Composition of Flora:

I. Vascular Flora:

The vascular plants of Nova Scotia are divided into a number of groups called floral elements (Fig. F-1).

a) Arctic-alpine element. Plants of northern bogs and barrens; in Nova Scotia exist as relic-colonies and cliff-faces and talus slopes or in isolated valleys and ravines. No examples are found in Kejimkujik National Park.

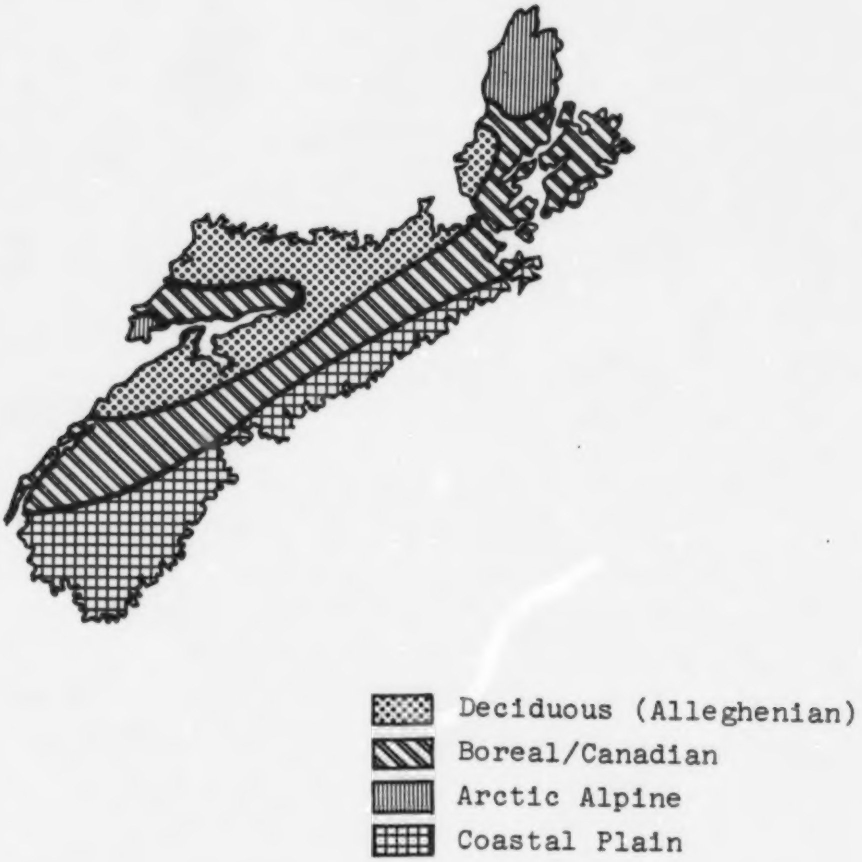
b) Boreal element. Plants of northern evergreen forests ranging from Newfoundland and Nova Scotia to Alaska; found in coniferous woods and associated swamps, swales and bogs.

c) Canadian element. Common background flora of northeast North America ranging from Newfoundland to Manitoba, south to Pennsylvania, North Carolina and Tennessee; common background flora of Nova Scotia.

d) Deciduous (or Alleghenian) element. Plants of the southern deciduous climax forest of eastern United States; found in rich woodlands and along river intervales.

d) Coastal Plain element. Plants of the coastal plain from Texas along north side of Gulf of Mexico and as a narrow band up eastern side of U. S. to New England; in southwestern flora in N. S., which ranges south of a line

Figure F-1 Floral Elements of Nova Scotia


Deciduous (Alleghenian)
Boreal/Canadian
Arctic Alpine
Coastal Plain

Source: after Roland and Smith, 1969

from Digby Neck to Mahone Bay with isolated stations near Halifax and northward to Grand Lake. (Fig. F-2.) The coastal plain species are divided into three groups:

i) plants found nowhere else in Canada;

ii) plants common on the coastal plain but with isolated stations in southern parts of Ontario, Quebec and New Brunswick; and

iii) plants very common on the coastal plain and with a wide distribution off it.

Kejimkujik National Park has a marginal position near the northern edge of the range of the southwestern flora (Fig. F-2) and has only a modest representation of the coastal plain element (Roland and Smith, 1969; Roland, 1980).

The total flora of the Park consists of about 544 species of vascular plants (Fig. F-3, Appendix F-4):

a) about 404 species (74%) of Boreal and Canadian elements form the background flora of native plants;

b) about 84 introduced species (15%) from Europe and western Canada--most are weedy species (hawkweeds, clovers, vetches, grasses and dandelions) grow along roadsides or around buildings and campgrounds where the soil has been disturbed. Some (apple and Queen Anne's Lace) are remnants of previous agricultural land use. A few (Broom and Purple Loosestrife) are large aggressive species with the ability for rapid and wide dispersion.

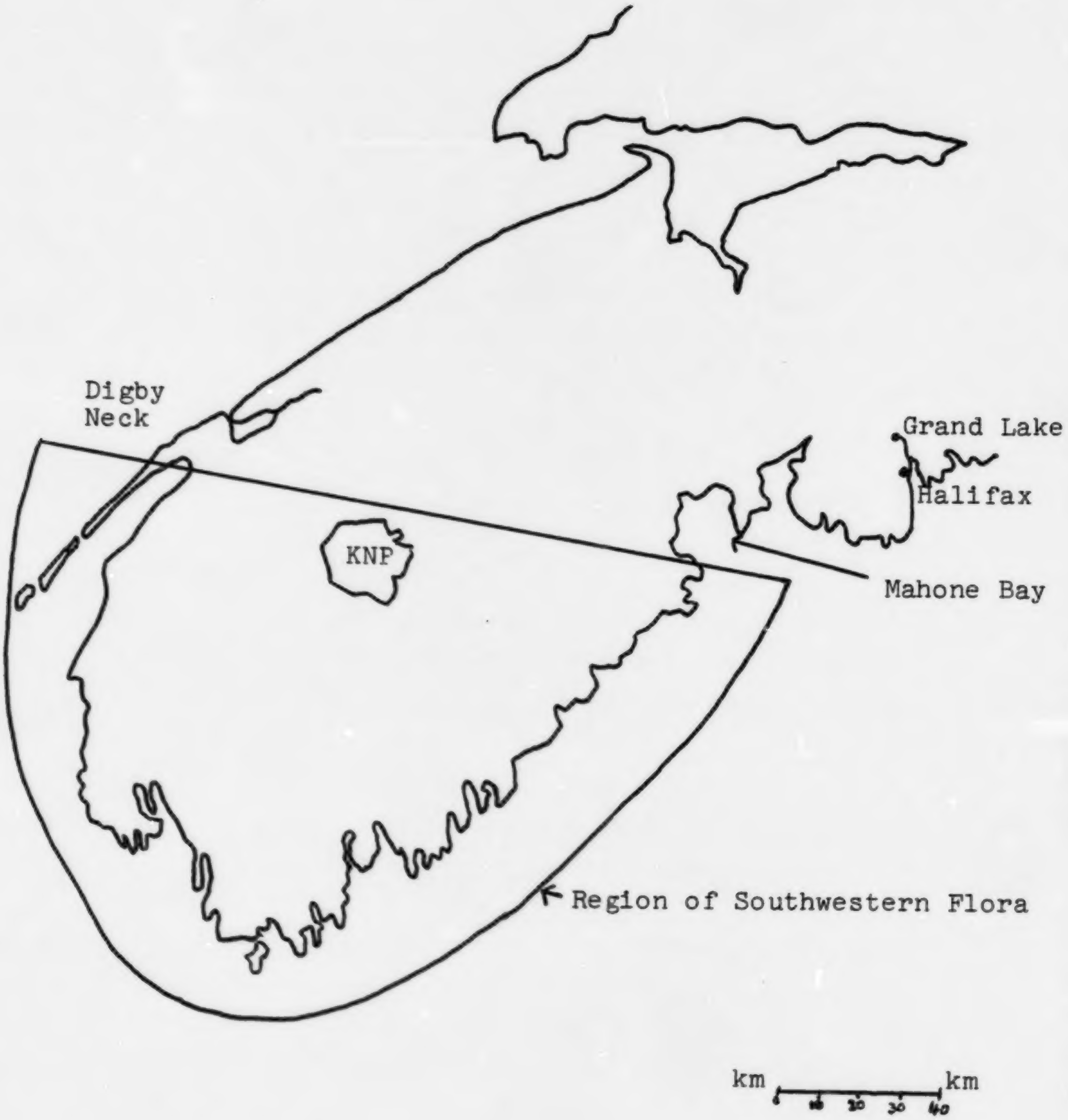

Digby Neck
Grand Lake
Halifax
KNP
Mahone Bay
Region of Southwestern Flora
km
0 10 20 30 40
km

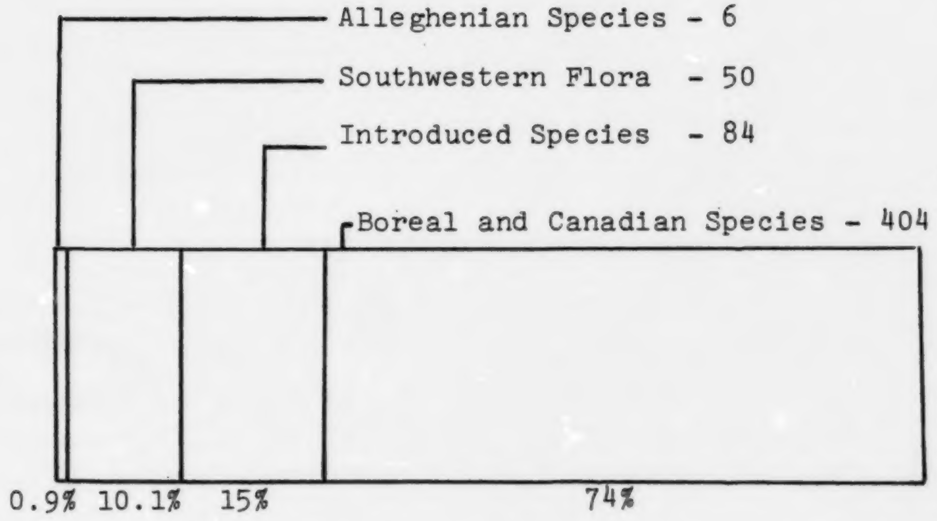
Figure F-2 Diagram of southwestern Nova Scotia showing extent of distribution of Southwestern Flora (adapted from Keddy, 1979).

c) about 50 species (10.1%) of the southwestern flora which includes about 36 species of the Coastal Plain element with a very restricted distribution in Canada;

d) six species (0.9%) of the Alleghenian element typical of rich deciduous forests and with a restricted provincial range.

There are 23 species of ferns, about 15 species of orchids and about 37 aquatic species. Ninety species (17% of the flora) are woody plants.

Figure F-3 Composition of Vascular Flora of Kejimkujik National Park



II. Non-vascular Flora:

Mosses

The distribution of mosses in Nova Scotia is very similar to that of the sub-floras of vascular plants with the known species tentatively divided into 6 groups: (1) Coastal Plain; (2) Arctic tundra; (3) Boreal forest; (4) Hardwood forest; (5) Second-growth woodland; and (6) Weeds of cultivation (Erskine, 1968). The list of mosses known to be in the Park is compiled from work done by several researchers and includes 117 species (Appendix F-1). Many are known by a single report only and a number of species common in the province are not yet reported from the Park.

Liverworts

Liverworts have been but little collected. Only 31 of the 133 species listed by Erskine for the province are known from the Park (Appendix F-2) (Roland, 1980). Most of the liverworts are widely distributed but small, requiring use of a handlens to be seen.

Lichens

Lichens are abundant in the Park with a few kinds being very conspicuous and easily identified. However, there are many unidentified. About 101 species are known to date (Appendix F-3).

Fungi

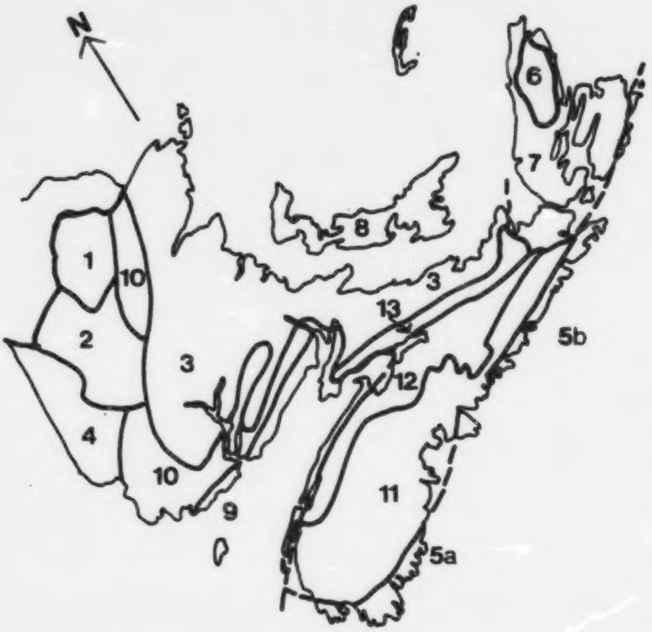
No formal studies have been done on the fungi and no presence list of species is available. The fungi flora of the Maritime region is relatively rich and it is expected that the Park region would be a good habitat for fungi because of the combination of moist conditions and abundance of rotting vegetation.

Vegetation Associations:

I. Forest Associations:

The location of the Park was chosen to include vegetation representative of the Atlantic Uplands Section of the Acadian Forest Region (Fig. F-4). The distinguishing feature of the Atlantic Uplands forest is the presence of Red Spruce (*Picea rubens*), with other dominant trees being Eastern Hemlock (*Tsuga canadensis*), Sugar Maple (*Acer saccharum*), Red Maple (*Acer rubrum*), White Pine (*Pinus strobus*), Red Pine (*Pinus resinosa*), Yellow Birch (*Betula allegheniensis*), White Birch (*Betula papyrifera*), Beech (*Fagus grandifolia*), White Ash (*Fraxinus americana*), White Spruce (*Picea glauca*), and Balsam Fir (*Abies balsamea*) (Rowe, 1972). Additional species which grow there are Black Spruce (*Picea mariana*), Red Oak (*Quercus rubra*), Larch (*Larix laricina*), Large-toothed Aspen (*Populus grandidentata*), Trembling Aspen (*Populus tremuloides*), Gray Birch (*Betula populifolia*), Black Ash (*Fraxinus nigra*), and Hop-Hornbeam (*Ostrya virginiana*).

Figure F-4 Acadian Forest Region



1	New Brunswick Uplands
2	Upper Miramichi-Tobique
3	Eastern Lowlands
4	Carleton
5a	South Atlantic Shore
5b	East Atlantic Shore
6	Cape Breton Plateau
7	Cape Breton-Antigonish
8	Prince Edward Island
9	Fundy Coast
10	Southern Uplands
11	Atlantic Uplands
12	Central Lowlands
13	Cobequid

Source: Rowe, 1972

Further characterization by Loucks (1962) identifies two main types of climax vegetation for the Atlantic Uplands Section: Sugar Maple/Hemlock/White Pine in the drumlin areas underlain by slate, and Red Spruce/Hemlock/White Pine in areas where the bedrock is granite and quartzite. Due to many disturbances in the region since man's arrival the contemporary vegetation is characterized as a mixed coniferous forest in which a variety of associations is recognized (Gimbarzevsky, 1975).

The distribution of the vegetation associations is closely related to the drainage conditions of the soil, while their composition is due mainly to the processes of change in the region since man's arrival. Gimbarzevsky's study in 1975 recognized 14 forest and 25 ground vegetation associations with drainage conditions as the most influential factor in their distribution.

Forests form about 94% of the vegetation with the average age of the stands being less than 100 years. The native tree species, grouped according to their abundance are listed in Table F-1.

In Table F-2 the 14 forest associations are described under 8 headings according to the dominant species. The types of different ground vegetation in the forest assocications are noted in Table F-2 and Table F-3.

Table F-1 Native Trees of Kejimkujik National Park (Relative Abundance from Roland, 1980)

Abundant	Common	Occasional	Uncommon
Eastern Hemlock	Larch	Red Pine	Ironwood (Hop-Hornbeam)
Black Spruce	Beech	Sugar Maple	
Red Spruce	Gray Birch	White Ash	
White Pine	White Spruce	Black Ash	
White Birch	Striped Maple	Yellow Birch	
Balsam Fir	Large-toothed Aspen	Trembling Aspen	
Red Maple			
Red Oak			

Table F-2 Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
	Coniferous and Coniferous-Dominated Associations		
WETLAND			
1. Black Spruce-Red Maple a) Black Spruce-Larch-Red Maple b) Black Spruce-Fir-Red Maple	Small patches of a single species in mixture of all three; at edge of wet bogs; Larch and Spruce on wettest sites; Fir on drier sites. Minor species: Red Spruce, Pine, Hemlock Ground veg.: Carex-Sphagnum Assn. or Osmunda Assn. or Humus-Bryophyte Assn.	Trend toward crown closure and drier soil conditions; Larch would be replaced by Fir; Black Spruce and Red Maple persist in a variety of conditions (e.g. periodic flooding).	18% 5306 ha

Table F-2 (cont.) Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
	Coniferous and Coniferous-Dominated Associations		
UPLAND			
2. Red Spruce-Fir-White Pine (+ hardwoods)	Heterogeneous or homogeneous stands; a few large old residual conifers emerging above the canopy; in (c) stands the basal area of Spruce equals the combined basal areas of Pine and Fir; may be heavy Fir regeneration. Ground veg.: *Pteridium* Assn.	Much evidence of cutting and fire; some stands may be result of invasion of hardwoods into clearings left by selective cutting in pure coniferous stands; a shift to pure coniferous in absence of future disturbance.	32% 8688 ha (largest forest assn.)
a) Red Spruce-Fir-Pine (Red Maple-White Birch)			
b) Red Spruce-Fir-Pine (Red Maple-White Birch-Red Oak)			
c) Red Spruce-Fir-Pine			

Table F-2 (cont.) Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
3. Red Spruce-Hemlock-White Pine (+ hardwoods) a) Red Spruce-Hemlock-Pine (Red Maple-White Birch) b) Red Spruce-Hemlock-Pine (Red Maple-White Birch -Oak) c) Hemlock-Red Spruce-Pine	Large old relic conifers from former stands often present; Hemlock dominant in (c), esp. on upper slopes of drumlins (dry to very dry) (up to 50% of total basal area). Minor Species: Red Pine and Large-toothed Aspen; Fir on more moist sites. Ground Veg.: (a) and (b): *Pteridium* Assn.; (c): *Humus-Bryophyte* Assn.	Trend toward pure coniferous stands; selective cutting and fire have resulted in hardwood invasion of (a) and (b); (c) is undisturbed (old-growth near-climax).	9% 2629 ha

Table F-2 (cont.) Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
4. White Pine-Red Spruce (+ hardwoods)	Many different ages, heights and densities; usually on well-drained rocky hillsides; infrequent large White Pine.	Most sites were logged selectively resulting in uneven-aged mixed stands; trend to pure coniferous but openings may be re-invaded by hardwoods.	8% 2550 ha
a) White Pine-Red Spruce (Red Maple-White Birch) b) White Pine-Red or White Spruce	Minor Species: Fir, Hemlock, Beech, Aspen, Red Maple, White Birch, Red Oak, White Pine, and Red Spruce invade abandoned fields; similar stands may occur on hillsides as a transition between 2 (a) and 3 (b). Ground Veg.: Pteridium Assn.		

Table F-2 (cont.) Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
5. White or Red Pine	Pure White or Red (less frequent) Pine stands of three types: 1) large widely-spaced White Pine which have survived fires (understory of hardwoods); 2) old field White Pine stands 3) Red Pine on lakeshores Ground Veg.: Pteridium Assn.	There are few large old White Pine in Park as it was the desired species in most logging activities.	9% 2653 ha

Table F-2 (cont.) Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
WETLAND			
6. Red Maple-White Birch (includes floodplains)	Understories usually lush with shrubs and tree regeneration; Birch makes best growth on drier sites while Maple grows on wetter sites (floodplains); floodplain veg. of three zones: 1) sedge-grass meadows (no trees) 2) shrub zone (Alder, Sweet Gale) 3) wetland forest Minor species: Red Oak, Large-toothed Aspen, large old Yellow Birch. Ground veg.: *Carex*-*Sphagnum* Assn. or *Osmunda* Assn. on floodplains; *Dryopteris* Assn. in drier areas.	Periodic flooding limits invasion of other species, thus floodplain forests are relatively stable (disclimax); on drier sites early successional species may be replaced by more tolerant deciduous species; fire and logging have disturbed many of these stands in the last 100 years.	3% 871 ha

Table F-2 (cont.) Forest Associations (Adapted from Gimbarzevsky, 1975)

Associations	Characteristics	Comments	Extent
UPLAND			
7. Red Maple-Red Oak-White Birch (+ Beech and conifers)	Some large old pines may be present on driest sites in Park (well-drained drumlins) Minor Species: White Pine, Red Spruce and Aspen; normally Beech would be an important species but is not because of disease. Ground veg.: *Pteridium*, *Dryopteris* and *Fagus* Assns.	An early successional association which has invaded dry sites after fire; Pine and Spruce enter as understory species, resulting in coniferous-dominated mixed stands (No. 4).	20% 6137 ha
8. Sugar Maple-Yellow Birch-White Ash (Beech)	Large old deciduous species. Ground veg.: *Dryopteris* assn.	Mature near-climax stands.	1% 163 ha

Table F-3 Description of the Ground Vegetation in the Forest Associations (Stanley et al, 1973)

Association	Characteristics	Plant Species	Occurrence
Carex-Sphagnum	In wet woods, flat to slightly hommocky; typical floodplain veg. found under forest cover.	Dominant: *C. stricta*, *Sphagnum* spp. Sub-dominant: Red Maple, *Calamagrostis canadensis* Characteristic: *Toxicodendron radicans* var. Significant: *Carex bullata*	Inness Brook area; Peskowesk Brook glade; along Rogers Brook, Mersey River and most streams
Osmunda	In wet woods; flat to slightly hummocky; most complex assn., floristically.	Dominant: *O. cinnamomea*, *Sphagnum* spp. Sub-dominant: Red Maple, *Kalmia angustifolia* Characteristic: *Calla palustris*, *Epilobium palustre*, *Toxicodendron radicans* var. Significant: *Dryopteris simulata*, *Calla palustris*, *C. bullata*	Extent in Park unknown; specific locations not identified.

Table F-3 (cont.) Description of the Ground Vegetation in the Forest Associations (Stanley et al, 1973)

Association	Characteristics	Plant Species	Occurrence
Humus-Bryophyte	In coniferous or coniferous-dominated woods; moderately hummocky; mesic to dry; poor light; hemlock stands with this assn. approach virgin condition.	Dominant: none Sub-dominant: Pleurozium schreberi, Bazzania trilobata Significant: Corallorhiza maculata, Goodyera tesselata	IBP Hemlock stand at Big Dam East Lake; near Dennis Boot Lake; Hog, Hemlock and McLean Islands.
Dryopteris	Hummocky with good humus layer; mesic deciduous woods.	Dominant: D. spinulosa Sub-dominant: Polystichum acrostichoides, Oxalis montana, Polygonatum pubescens Significant: Sugar Maple, D. marginalis	Peale Island, Fire Tower hill woods; Indian Pt. Pen., Grafton Lake area; jct. Peskowesk Rd. and Peter Pt. Trail.
Pteridium	Moderately hummocky; open second-growth mixed woods; occasionally in pure coniferous or deciduous stands.	Dominant: P. aquilinum var. Sub-dominant: Vaccinium angustifolium, Kalmia angustifolia, Cornus canadensis Characteristic: Corylus cornuta, Ilex glabra, G. tesselata	In about 76% of forest area due to fire, logging and windfall.

Table F-3 (cont.) Description of the Ground Vegetation in the Forest Associations (Stanley et al, 1973)

Association	Characteristics	Plant Species	Occurrence
Fagus	Moderately hummocky; in dry deciduous or deciduous-dominated woods; appears to be confined to drumlins in slate areas.	Dominant: none Characteristic: *Epifagus virginiana* Significant: *E. virginiana*, Sugar Maple, Yellow Birch	Beech Grove Trail, Grafton Lake area.
Polypodium	On large boulders where organic material has accumulated.	Dominant: *P. virginianum* Characteristic: *P. virginianum*	Scattered in forests of Park.

II. Non-forest Vegetation Associations:

About 6% of the land area in the Park is not forested. About 5.6% of this is poorly-drained land (e.g. marshes, bogs and wetland complexes associated with shorelines) and 0.4% abandoned farmland, roadside embankments, parking lots and service areas. Twenty-one vegetation associations including 4 aquatic ones are described in Table F-4, under the following habitat headings:

1. aquatic
2. lakeshore
3. marsh
4. bog
5. fire barrens
6. miscellaneous

Table F-4 Description of Non-Forest Vegetation Associations, Adapted from Stanley, et al, 1973 with Aquatic Associations from Stewart, 1984

1. AQUATIC ASSOCIATIONS

Association	Characteristics	Plant Species	Occurrence
Sphagnum-*Utricularia*	In sheltered bays with rocky substrate, in water 0.5 m to 10 m deep; acid water both dark and clear; loose *Sphagnum* mat on lake bottom overlain by *Utricularia* spp.	Dominant: *S. macrophyllum*, *S. torreyanum*, *S. cuspidatum* Sub-dominant: *U. purpurea*, *U. vulgaris*	Beaverskin, Pebbleloggitch, Big Red, Puzzle, North Cranberry and Kejimkujik Lakes
Floating-leaf (Stewart) (similar to *Nymphaea*-*Nuphar* of Stanley *et al*)	In water 1-2 m deep, in sandy to organic silt and muck over coarse to rocky substrate in lakes, ponds and slow-moving streams; an artificial assn. in which dominant species often occur in monospecific stands or with other associations.	Major: *N. variegatum*, *Nymphaea odorata*, *Hydrocotyle umbellata*, *Brasenia schreberi*, *Potamogeton confervoides*, *P. epihydrus*, *Sparganium angustifolium*	About 30 ha; limited locally in size, but distributed widely through Park (Jeremys' Bay, Puzzle, McGinty and Mud Lakes - Stewart)

Table F-4 (cont.) Description of Non-Forest Vegetation Associations, Adapted from Stanley et al, 1973, with Aquatic Associations from Stewart, 1984

1. AQUATIC ASSOCIATIONS (cont.)

Association	Characteristics	Plant Species	Occurrence
- Lobelia Eriocaulon - Eleocharis (Stewart) (Similar to Pontederia of Stanley et al)	In silt over coarse substrate; shallow water; often forms a sward; intergrades with Lobelia-Lysimachia of lakeshore assns.	Dominant: Eriocaulon septangulare Sub-dominant: L. dortmanna, Eleocharis acicularis; Pontederia cordata in shallow water; Nymphoides cordata in deeper areas.	Beaverskin, Pebbleloggitch and Kejimkujik Lakes.
Scirpus	Forms dense mats, usually in flowing water; frequently monospecific.	Dominant: S. subterminalis; U. purpurea and U. vulgaris occur frequently.	Kejimkujik Lake at mouth of Mersey River; Pebbleloggitch, Cobrielle and Still Brook.

2. LAKESHORE ASSOCIATIONS

Lobelia-Lysimachia	Generally on coarse sand or gravel near shore in areas continually inundated; remains dormant until late summer when lake water levels at lowest.	Dominant: L. dortmanna, L. terrestris, Eriocaulon septangulare Sub-dominant: Cladium mariscoides; P. cordata common in shallow areas; N. cordata in deeper parts Significant: Solidago galetorum, Gratiola aurea	Beaverskin, Pebbleloggitch and Kejimkujik Lakes

Table F-4 (cont.) Description of Non-forest Vegetation Associations Adapted from Stanley et al, 1973 with Aquatic Associations from Stewart, 1984

2. LAKESHORE ASSOCIATIONS (cont.)

Association	Characteristics	Plant Species	Occurrence
Juncus-Solidago	Most important assn. for coastal plain species; flat with slight depressions; restricted to sand, gravel, cobble and peat beaches; flooded in spring, wet to moist until fall; med. to tall herbaceous vegetation and in places, a well-developed shrub layer; herbaceous species are late summer emergents, remaining dormant until lakeshores no longer inundated.	Dominant: S. galetorum, J. filiformis, G. aurea Sub-dominant: L. terrestris, Spartina pectinata Characteristic: J. filiformis Significant: G. aurea, S. galetorum, Glyceria obtusa, Carex bullata, Xyris caroliniana	narrow border on northeast, southeast and south sides of Kejimkujik Lake and narrow strips on other lakes.
Spartina	Exposed, wind-swept rocky beaches; flat with slight inclination toward water; subject to spring flooding; sparse to moderate cover of tall grasses and low to medium shrubs.	Dominant: S. pectinata Sub-dominant: Panicum virgatum var. spissum Significant: P. virgatum var. spissum, S. galetorum, Utricularia subulata, Carex lenticularis var. blakei	west side of Kejimkujik Lake and of islands in that lake.

Table F-4 (cont.) Description of Non-forest Vegetation Associations Adapted from Stanley et al, 1973 with Aquatic Associations from Stewart, 1984

2. LAKESHORE ASSOCIATIONS (cont.)

Association	Characteristics	Plant Species	Occurrence
Gaylussacia	Dry, exposed points and shorelines; on dry upper beach as buffer zone between beach vegetation and forest; dense growth of low to medium shrubs.	Dominant: *G. baccata* Sub-dominant: *Myrica pensylvanica*, *Pteridium aquilinum* var. Characteristic: *M. pensylvanica* Significant: *Ilex glabra*, *Goodyera tesselata*	about 200 ha.

3. MARSH ASSOCIATIONS

Dulichium-Sphagnum	Flat to slightly hummocky; well-developed moss and herb layer; initial terrestrial stage in marsh succession.	Dominant: *D. arundinaceum*, *S. cuspidatum* Characteristic: *D. arundinaceum*	Extent unknown; definite locations not identified.
Osmunda-Myrica	Flat to occasional runnels; dense shrub and fern cover with well-developed moss layer; on low lake margins; vulnerable to ice movement in winter.	Dominant: *O. regalis*, *M. gale* Sub-dominant: *Cladopodiella fluitans* (liverwort) Significant: *P. virgatum* var. *spissum*, *Carex bullata*, *Isoptergium tenerum* (moss)	about 60 ha

Table F-4 (cont.) Description of Non-forest Vegetation Associations Adapted from Stanley et al, 1973 with Aquatic Associations from Stewart, 1984

3. MARSH ASSOCIATIONS (cont.)

Association	Characteristics	Plant Species	Occurrence
Calamagrostis-Carex	Tall grass and sedge meadow; moist, flat to slightly hummocky; well-developed shrub layer in some parts.	Dominant: C. canadensis Sub-dominant: C. stricta Significant: C. bullata, Decodon verticillatus, Dryopteris simulata	about 60 ha
Myrica-Chamaedaphne	Flat to slightly hummocky; border of low to medium shrubs along lake margins and slow streams.	Dominant: M. gale Sub-dominant: C. calyculata var. Significant: Carex bullata	about 120 ha
Alnus	Tall shrubs in moist depressions or along low moist to wet lake and stream margins.	Dominant: A. rugosa Sub-dominant: Carex stricta, Calamagrostis canadensis Significant: Alnus serrulata, Toxicodendron radicans subsp. radicans	60 to 80 ha

Table F-4 (cont.) Description of Non-forest Vegetation Associations Adapted from Stanley et al, 1973 with Aquatic Associations from Stewart, 1984

4. BOG ASSOCIATIONS

Association	Characteristics	Plant Species	Occurrence
Scheuchzeria-Sphagnum (quaking bog)	Occurs in areas once occupied by small ponds; thick floating humus mat of Sphagnum and sedges, growing over "pond" or covering it; vegetation low, species-poor.	Dominant: S. palustris, Sphagnum spp. Sub-dominant: Rhynchospora alba Significant: S. palustris	Heber Meadow, Fire Tower Road Bog, Little Red Lake area, North Cranberry Lake area, bog north of Channel Lake.
Chamaedaphne-Rhododendron	Flat to slightly hummocky; moist to dry, ground cover of humus and mosses, with dense covering of low heath shrubs and herbaceous species.	Dominant: C. calyculata var., R. canadense (sometimes one dominates to the exclusion of the other) Sub-dominant: Sphagnum spp. Significant: Carex bullata	frequent about 520 ha
Heath-Cladonia	Hummocky, dry; dense cover of medium shrubs over well-developed moss and lichen layer, interspersed with areas of lichens only (Cladonia spp.)	Dominant: Kalmia angustifolia, Cladonia spp. Sub-dominant: C. calyculata var. Characteristic: Polytrichum spp., Solidago uliginosa var., Empetrum nigrum, Scirpus cespitosus Significant: Gaylussacia dumosa var., Bartonia spp.	The most common bog association. about 800 ha

Table F-4 (cont.) Description of Non-forest Vegetation Associations Adapted from Stanley et al, 1973 with Aquatic Associations from Stewart 1984

Association	Characteristics	Plant Species	Occurrence
4. BOG ASSOCIATIONS (cont.)			
Heath-Black Spruce-Larch	Dense layer of low to tall shrubs with scattered trees; trees often stunted; transition zone to surrounding forest.	Dominant: Heath shrubs with invading Black Spruce, Larch and White Pine	Extent unknown; Specific locations not identified.
5. FIRE BARRENS ASSOCIATIONS			
Corema	Well-drained coarse till; slightly hummocky; disturbed post-fire vegetation (lichens, herbs and low shrubs).	Dominant: *Cladonia rangiferina*, *Corema conradii* Sub-dominant: *Arctostaphylos uva-ursi* var.	10 ha.
6. MISCELLANEOUS ASSOCIATIONS			
Scirpus-Juncus	Wet embankments and ditches; ground cover of mosses with medium to tall herbs.	Dominant: *J. effusus*, *S. cyperinus* Sub-dominant: *Agrostis alba*, *Sphagnum* spp.	less than 0.4 ha.

Table F-4 (cont.) Description of Non-forest Vegetation Associations Adapted from Stanley et al, 1973 with Aquatic Associations from Stewart, 1984

6. MISCELLANEOUS ASSOCIATIONS (cont.)

Association	Characteristics	Plant Species	Occurrence
Comptonia	Dry roadside embankments; dense cover of medium shrubs and herbs.	Dominant: C. peregrina Sub-dominant: A. alba Characteristic: Rudbeckia serotina	about 4 ha.
Agrostis	Formerly cultivated fields; dense cover of short to medium grasses and weeds, with a few shrubs; dry; often invaded by White Pine and Spruce in early successional stage to forest (in 20 to 30 years).	Dominant: A. perennans, Danthonia spicata Sub-dominant: Hieracium pilosella Characteristic: Apple, Ground Juniper	about 60 ha.

Forest Ground Vegetation Associations:

Seven of the 25 plant associations in Kejimkujik National Park are described as forest ground vegetation (Table F-3). The dominant species are the most influential and are usually the most conspicuous.

Characteristic species are confined mainly to one association in their distribution. Significant species have an unusual (or restricted) distribution in Nova Scotia and/or are rare in the Park (Stanley et al, 1973).

Processes of Change:

The natural rotation period for the vegetation of the area is 200 - 400 years (Wein, 1978) and as the average age of the stands in the Park is less than 100 years, it is evident that very little of the forest has been undisturbed. Lumbering, fire, wind, agriculture, insects, disease and recreation altered the vegetation prior to the establishment of the Park.

Forestry

Lumbering had the greatest impact in altering the original vegetation and creating the forest types of today. During the mid-19th and early 20th centuries, selective cutting to support an intensive exporting and ship-building industry removed much of the mature White Pine and Red Oak. The development of the pulp and paper industry and the establishment of the Mersey Paper Company in 1928 made further demands on the forests, with the most concentrated cutting in the south, southwest, central and northeast areas of the Park adjacent to lakes and streams. In the 1940's portable sawmills increased the logging into areas away from the waterways.

Fire History

The Kejimkujik area shows a fire cycle of 118 years (Wein, 1978). Little, if any, of the Park has been untouched by fire, but there have been no major occurrences since 1928. In southwestern Nova Scotia, repeated or severe burns have resulted in fire barrens (Martin, 1956) as found in two small areas (11 ha) in the Park. Both man and natural causes probably contributed to the fire history of Kejimkujik.

Storms

Historical evidence indicates a major wind or hurricane in the Maritimes about every 80 years, with the last one being Hurricane Edna in 1954. Adverse wind influence is apparent in tree blowdowns on islands in Kejimkujik and Cobrielle Lakes and near Dennis Boot Lake.

Farming

Agriculture's impact on the Park vegetation has been minor because of poor growing conditions. Suitable land, found on drumlins, was confined to the east and southeast sections with the best sites around Grafton Lake and north of it near the Park entrance. Many of the old fields have reverted to White Pine stands.

Diseases and Insect Infestations

Disease and insect pests have affected a number of tree species in the Park and in southwest Nova Scotia in general but the area does not seem to have suffered from sustained endemic insect damage. Sprude Budworm defoliation is light in the Park due in part to the mixed type of forest. Populations of Larch Sawfly which attacks mature Larch are cyclic and small. White Pine Weevil is common on young White Pine, especially in open abandoned fields. A mixture of deciduous species with the pine helps to control this pest and White Pine is regenerating under many mixed woods stands. Cyclic infestations of oak defoliating insects, e.g. *Croesia semipurpurana*, occur in southwest Nova Scotia and may cause branch and crown dieback.

Deciduous species seem to have suffered more from introduced pests and disease. Sporadic attacks of Birch Dieback disease in the 1930's and the European Winter Moth in the 1940's affected Yellow and White Birch and Red Oak respectively. The most serious one is Beech Bark Disease which was introduced into Nova Scotia at the Halifax Public Gardens in the 1920's. It is the result of the combined activity of a scale insect and a fungus which disfigures and stunts the trees and is evident wherever Beech occurs. As it is an ongoing infection which usually kills trees before maturity, Beech is not likely to increase in abundance in the Park. (The reader should refer to the Invertebrate chapter in this document for further discussion of forest insects of note.)

Pollution Impact

Acid precipitation is an environmental hazard which has been recognized during the last two decades since the establishment of the Park. Research has not yet provided any quantitative results as to its effect on forest productivity to date (1985) but has demonstrated its potential to decrease seedling growth, especially in Red and White Spruce (Percy, 1982) and thus to influence succession.

Succession:

Today there is little undisturbed climax vegetation in the Park but a few near-climax deciduous and coniferous stands have been preserved (Stanley _et al_, 1973). Species typical of the mature Acadian Forest (Sugar Maple, Yellow Birch and Beech) are uncommon while early colonizing species (Red Maple, Large-toothed Aspen, Gray and White Birch) have increased. Mature stands with a mixture of age and size classes have been replaced by even-aged stands in clear-cut or burned-over areas (Table F-5).

Table F-5 Percentage of Forest Stands in Age Classes as of 1972

10-30	31-60	61-80	81+	retarded growth
4%	57%	21%	6%	12%

Succession is determined by a number of factors (e.g. variations in soil types, vegetation relationships, available seed sources, environmental factors) which have not been fully researched for the Park forests, so only possible trends may be outlined. Wet sites may support Red Maple and/or Larch for long periods of time, due to periodic flooding. Eventually Black Spruce, Fir and White Pine may become established, replacing Red Maple and Larch. As conditions become more dry, Hemlock may replace Fir and become the dominant species. On drier sites, fire has had a strong influence on vegetation development. In some areas, Red Spruce and White Pine followed fire. In the eastern part of the Park, Maple/Oak/Birch stands developed after fire, with occasional pure stands of Large-toothed Aspen in the driest sites. Relic White Pine are often scattered throughout these stands and may act as a seed source for future White Pine stands.

Evaluation:

Management Objectives:

1. To maintain natural environmental conditions with respect to indigenous vegetation within the Park so as to preserve the habitat, species and significant locations representative of the Atlantic Uplands Forest Region.

2. To establish a rare plant management strategy for the long-term protection, understanding, appreciation and enjoyment of rare plants in the Park, consistent with Parks Canada policy.

3. To determine management priorities for rare plant species through application of a thorough verification and priorization process.

4. To maintain specific habitat conditions essential for the survival of rare and endangered flora in areas large enough to ensure appropriate gene pool preservation.

5. To maintain up-to-date information on the status of vegetation by monitoring and documentation of natural processes and human impacts.

6. To monitor the effectiveness of implemented mitigative measures and to identify additional corrective action as required.

7. To avoid deliberate introduction and establishment of exotic vegetation and to remove exotic species where feasible.

Significant and Rare Plant Species:

Rare Species Status:

Information for the status of plant species in the Park was obtained from Maher et al, 1978; Roland, 1976, 1980; Stanley et al, 1973 and Stewart, 1984. Distribution maps prepared by Roland (1976) and Bowers (1977-1980) and updated by various Park personnel provided specific information about coastal plain species.

A rare species is any indigenous species of flora with a restricted distribution and/or low numbers in a given geographic area (Reznicek, 1983). Types of rarity are:

1. disjunct - species are separated from the range of the rest of the species as a result of recent long-range dispersal or as a relic population left behind from when the species were more widespread;
2. endemic - species found only within a very restricted geographic area; and
3. low numbers of plants in a small area, low numbers over a wide area and large numbers limited to a small area.

About 85 species in the Park fall into one or more of the above categories. Thirty-six (of the Coastal Plain element) have a restricted distribution in Canada and are considered relic species in the southwestern flora (Roland, 1976). Nineteen are on the list of species rare or threatened in the province (Maher et al, 1978) (see Table F-6).

The rarest plant in the Park and a typical coastal plain species far north of any other known location in North America is Hydrocotyle umbellata. In Canada it occurs in two localities only (Kejimkujik National Park and in St. John Lake, Yarmouth County), both in southwest Nova Scotia. The species is on the COSEWIC list of endangered species in Canada.

The majority of the coastal plain species are small herbs which grow on lakeshores, mainly along the north and east sides of Kejimkujik Lake and around some of the islands, with isolated stations along lakes in the southeast part of the Park. Many stations consist of one individual only or a small clump of individuals covering less than 1 sq. m. of habitat. A few species are frequent in their particular habitat along the lakeshores but restricted in provincial and national distribution. Although some of the significant species have been found in up to 60 stations between 1976 and 1984 (the period for recorded sightings) it is not known at present if all stations are extant.

Priorization of Rare Species:

Evaluation and ranking of rare species according to their needs for protection and possible management are done using a priorization system based on guidelines established by Reznicek (1983) and Brownell and Norris (1983). This consists of three steps using the most readily available data.

Step I ranks the species according to their rarity on seven levels:

1. Park;
2. local - area included in circle 30 km in radius from centre of Park;
3. regional - southwest Nova Scotia;
4. provincial;
5. national;
6. adjacent state - New Brunswick and Maine;
7. continental.

This divides the plants into four priority levels. Priority I includes plants which are rare throughout a large part of their range in North America and which may become threatened or endangered. Study and protection management are immediate needs for these species. Priority II reflects rarity in the province and Canada. These species require monitoring, passive management and study within five years. Priority III reflects rarity in the Park and region or abundance in the Park and region and rarity in the province and Canada. They require periodic monitoring but no special emphasis concerning management. Priority IV species are rare on one or two levels. They require no special monitoring but may be reviewed at the next species ranking.

Step II ranks the species within each priority level according to ecological restrictions on the species. Step II deals with population biology of the species. Steps II and III are not done for Kejimkujik National Park due to lack of information.

Table F-6 Priorized Species of Rare Status

KEY

Species:

A - Allegheniar
CP - Coastal Plain
Re - Relic
+ - Rare or threatened in Nova Scotia

Status:

R - Rare
THR - Threatened
A - Absent
- - Uncommon to common
Res - Restricted
En - Endemic
End - Endangered

KNP - based on Roland (1976 & 1980); rare if 10 or less stations in KNP or if all stations highly localized.

Local - circle with 30 km radius from centre of KN (central SW N.S., including boundaries of Tobeatic Game Preserve, not including coastal habitats).

Regional - Southwestern half of mainland N.S., local and regional status estimated from Roland and Smith (1969); if not known, assumed to be rare.

Provincial - from Maher *et al* (1978) or Roland and Smith (1969).

Canadian - from Scoggan (1978-79) or Rare Vascular Plant series (National Museum).

Adjacent State - Rare if rare in one of: New Brunswick, Maine.

N.A. - North America

Priority Rating - I (top priority) to IV (not rare on any level); see p. F-40.

Verified by Roland unless otherwise noted.

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY I: Rare on 5 or more of the 7 levels; indicates a restricted range in North America and rarity throughout a large part of that range with the possibility of becoming threatened or endangered.

Species				Status								Location in Park
(with common name, comments)				KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
+	Re	CP	Alnus serrulata Smooth Green Alder -shrub borders at lake margins	R	R	R	R	R	-	-	I	South end of Big Dam East Lake; east side of Jim Charles Pt. near Kedge Beach; Hog Is.; Peter Pt.; Snake Lake area; Mersey R. bank, near Oak Ledges below Mill Falls; east side Indian Pt. Peninsula. (8)
			Amelanchier lucida Indian Pear or Serviceberry -endemic (Roland & Smith, 1969) -old fields	-	-	-	En.	Res	Ab.	Res	I	Endemic to Nova Scotia; occasional in field near Park entrance.

Table F-6 (cont.) Priorized Species of Rare Status

			Species (with common name, comments)	Status KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	Location in Park
+			*Asclepias incarnata* vars. Swamp Milkweed -of southwestern flora -wet or rocky thickets near stream or lake	R	R	R	R	R	-	Res	I	Mersey R. Islands above Jake's Landing; rocky beach east of Grafton L.; by brook on McGinty Lake Rd. (4)
+			*Aster undulatus* Wavy-leaved Aster -forest edge	R	R	R	R	R	-	Res	I	At edge of woods near Fish Hatchery. (1)
	Re	CP	*Bartonia virginica* Bartonia -peaty soil in semi-shade; lake margins	R	?	-	R	R	Thr in NB	Res	I	West side of Kejimkujik L. near Forest Is.; Forest Is.; Dukeshire Is.; near Snake L. on Kej. Lake; south end of Eastern Run; Peskowesk Lake. (6)

Table F-6 (cont.) Priorized Species of Rare Status

			Species	Status								Location in Park
			(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
	Re	CP	Carex howei Sedge -shady wet peaty areas near rivers or lakes	R	R	-	R	R	R in NB	Res	I	Near Jake's Landing; shore of Minard's Bay. (2)
+			Carex laxiflora Sedge -Dryopteris association in hardwoods	R	R	R	R	R	R	R	I	Indian Pt. peninsula, in Maple/Birch/Beech woods. (1)
+	Re	CP	Cephalanthus occidentalis Buttonbush -shrubby lakeshores or wet meadows	-	R	R	R	Res	-	Res	I	Restricted to lake margins in northeast part of Park (heavily browsed by deer). (47)

Table F-6 (cont.) Priorized Species of Rare Status

			Species	Status								Location in Park
			(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
			Ceratophyllum echinatum Hornwort -new to province -verified by P. Catling -aquatic	R	?	?	?	Res	R	Res	I	Hilchemakaar Lake. (1)
+			*Conopholis americana* Cancer-root -in hardwoods	R	R	R	R	R	R	Res	I	Grafton Lake trail woods; woods west of Grafton Brook. (2)
+	Re	CP	*Decodon verticillatus* var. *laevigatus* Swamp Loosestrife -shallow water, peaty soil at stream margin	-	R	R	Thr	Res	Abs	-	I	Restricted to south half of Park, chiefly where streams enter or exit from lakes; common around Mud Lake. (20)

Table F-6 (cont.) Priorized Species of Rare Status

			Species	Status								Location in Park
			(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
+		A	Desmodium canadense Canada Tick-Clover -threatened in N.S. (Maher et al, 1978) -upper part of sand and gravel beach	R	R	R	Thr	Res	-	-	I	Along beach in cove south of Fairy Bay (heavily browsed by deer); Kedge swimming beach. (2)
+		A	Desmodium glutinosum Tick-Clover -forest edge	R	R	R	R	Res	-	-	I	Edge of woods near Fish Hatchery. (1)
+	Re	CP	Hydrocotyle umbellata Water Pennywort -on endangered list (COSEWIC) -shallow water or wet sand beach	R	R	R	Thr or End	R	Abs	Res	I	East side of Jeremys Bay near Meadow Beach campground; cove east side of Indian Point peninsula; cove south of Fairy Bay; northeast end of George Lake. (4)

Table F-6 (cont.) Priorized Species of Rare Status

	Species	Status								Location in Park
	(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
	Isoetes acadiensis Quillwort -new to province; verified by P. Catling -aquatic	R	?	?	?	?	?	?	I	Little Peskowesk L.; Mud Lake; Big Dam West Lake; Kejimkujik Lake; George Lake; Loon Lake. (6)
+	*Myriophyllum farwellii* Water-milfoil -aquatic	R	R	R	R	Res	-	-	I	Grafton Lake; Big Dam East Lake; Hilchemakaar Lake; Cobrielle Lake; North Cranberry Lake; Puzzle Lake; George Lake; Loon L.; Peskowesk Lake. (10)
+	*Najas gracillima* Naiad -verified by P. Catling -aquatic	R	?	R	R	R	R	-	I	Big Dam East Lake; Hilchemakaar Lake. (2)

Table F-6 (cont.) Priorized Species of Rare Status

			Species	Status								Location in Park
			(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
	Re	CP	Panicum clandestinum Panic Grass -upper part of gravel beach	R	R	R	R	R	Abs	Res	I	Near old mill-site in cove south of Fairy Bay. (1)
+	Re	CP	Panicum dichotomiflorum var. puritanorum Panic Grass -threatened in N.S. -upper part of sand beach	R	R	R	Thr	-	Abs	Res	I	West side of Indian Pt.; beach in cove south of Fairy Bay; sandy point at exit of Grafton Brook. (3)
+	Re	CP	Panicum longifolium Panic Grass -peaty soil at lake edge	Res	R	R	R	Res	Abs	Res	I	Restricted to lake margins of Channel, Kejimkujik, George, and Loon Lake. (30)

Table F-6 (cont.) Priorized Species of Rare Status

			Species (with common name, comments)	Status KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	Location in Park
			Potamogeton pusillus var. pusillus Pondweed -new to province; verified by P. Catling -aquatic	?	?	?	?	?	?	?	I	Grafton Lake, McGinty Lake, Big Dam East Lake, Mud Lake, Kejimkujik Lake, Loon Lake (6).
+			Salix sericea Silky Willow -wet sedge meadow near lake margin	R	R	R	R	R	-	-	I	Swale at head of cove just west of Grafton Brook. (1)
			Schizaea pusilla Curly Grass Fern -very rare this far inland (Roland) -wet open bog	R	R	R	Res	Res	Abs	Res	I	Atkins Meadow Bog. (1)

Table F-6 (cont.) Priorized Species of Rare Status

Species				Status								Location in Park
(with common name, comments)				K NP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
+	Re	CP	Utricularia gibba Humped Bladderwort -wet peaty areas	R	R	R	R	R	-	-	I	Grafton Lake Boardwalk area; south end of Mud Lake. (2)
+	Re	CP	Utricularia radiata Bladderwort -shallow to deep water -aquatic	R	R	R	R	R	Abs	Res	I	South end of Big Dam East Lake; cove east side of Indian Pt.; Grafton Lake near dam; southwest side Puzzle Lake, near Portage C; North Cranberry Lake; McGinty Lake; Little Peskowesk Lake; Loon Lake. (9)
+	Re	CP	Utricularia subulata Subulate Bladderwort -peaty and sandy lake margins	Res	R	R	R	R	Abs	Res	I	Restricted chiefly to shores of Kejimkujik Lake and islands. (40)

Table F-6 (cont.) Priorized Species of Rare Status

Species				Status								Location in Park
(with common name, comments)				KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	
+	Re	CP	Woodwardia aerolata Dwarf Chain Fern -wet margin of brook in Red Maple swamp	R	R	-	R	R	Abs	Res	I	Woods at margin of Big Red Lake Brook, north end of Big Red Lake. (1)

PRIORITY II: Rare on 4 of 7 levels - common in Park, but rare provincially, nationally, adjacent state and North America or rare in Park, uncommon locally and regionally, and restricted or rare in rest of level; often reflects rarity in province and Canada.

	Re	CP	Cyperus dentatus Galingale -sandy lakeshores	-	?	-	R	R	R	Res	II	Chiefly in north-east part of Park. (26)
	Re	CP	Dryopteris simulata Bog Fern -wet meadows and stream banks	-	?	?	R	R	Res	R	II	Wet meadows and stream banks throughout Park. (25)

Table F-6 (cont.) Priorized Species of Rare Status

			Species (with common name, comments)	Status KNP	Local	Reg.	N.S.	Can.	Adj.St.	N.A.	Prior. Rating	Location in Park
			Rhexia virginica Meadow Beauty -of southwestern flora -sand and gravel lakeshores	-	?	-	Res	R	Abs	Res	II	Restricted to lakeshores in east half of Park. (63)
	Re	CP	*Sisyrinchium atlanticum* Blue-eyed Grass -sand and gravel shores	R	?	-	Res	Res	Abs	-	II	Lakeshores in northeast part of Park. (14)

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III: Rare on any 3 levels; rare in Park and region, but not in province or Canada or abundant in Park and region but rare in Canada and North America.

Species (with common name, comments)				Status KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
		A	Actaea pachypoda White Baneberry	R	R	R	-	-	-	-	III
			Amphicarpa bracteata Hog-peanut	R	R	R	-	-	-	-	III
			Apocynum cannabinum var. hypericifolium Indian Hemp	R	R	R	-	-	-	-	III
			Arethusa bulbosa Arethusa	R	R	R	-	-	-	-	III
	Re	CP	Bartonia paniculata Screwstem	R	-	-	-	R	R	-	III
	Re	CP	Carex bullata Sedge	-	-	-	-	Res. to N.S.	Abs.	Res.	III

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III

Species				Status							
(with common name, comments)				KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
			Eleocharis robbinsii Spikerush	R	R	-	-	-	R	-	III
	Re	CP	Gaylussacia dumosa var. bigeloviana Bog Huckleberry	R	R	-	-	Res.	-	Res.	III
			Geranium bicknellii Wild Geranium	R	?	?	R	-	-	-	III
	Re	CP	Glyceria laxa Rattlesnake Grass	R	-	-	Res.	Res.	-	-	III
	Re	CP	Glyceria obtusa Obtuse Manna Grass	-	-	-	-	Res.	R	Res.	III
	Re	CP	Gratiola aurea Golden-pert	-	-	-	Res.	Res.	-	-	III
			Habenaria hookeri Hooker's Fringed Orchid	R	R	R	-	-	-	-	III

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III

			Species	Status							
			(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
			Hieracium paniculatum Panicled Hawkweed	R	R	R	-	-	-	-	III
	Re	CP	Ilex glabra Inkberry	-	-	-	-	Res. to N.S.	R	Res.	III
	Re	CP	Lycopodium inundatum var. bigelovii Large Bog Clubmoss	-	-	-	-	Res.	R	Res.	III
			Mitella nuda Miterwort	R	R	R	-	-	-	-	III
		A	Osmorhiza claytoni Sweet Cicely	R	R	R	-	-	-	-	III
		A	Ostrya virginiana Hop-hornbeam or Ironwood	R	R	R	-	-	-	-	III

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III

Species				Status							
(with common name, comments)				KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
			Panicum lanuginosum var. septentrionale Panic Grass	R	R	R	Res.	-	-	-	III
	Re	CP	Panicum spretum Panic Grass	-	-	-	Res.	Res.	-	Res.	III
	Re	CP	Panicum virgatum var. spissum Panic Grass	-	-	-	Res.	Res.	-	Res.	III
		A	Polygonatum pubescens Downy Solomon's Seal	R	R	R	-	-	-	-	III
	Re	CP	Polygonum robustius White Water Smartweed	R	R	-	-	Res.	-	-	III
			Potentilla palustris Marsh Cinquefoil	R	R	R	-	-	-	-	III

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III

Species				Status							
(with common name, comments)				KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
	Re	CP	Solidago galetorum Slender-leaved Goldenrod	-	-	-	Res.	Res.	R	Res.	III
			Sparganium fluctuans Bur-reed	R	R	R	-	-	-	-	III
	Re	CP	Toxicodendron radicans subsp. radicans Poison Ivy	-	-	-	Res.	Res.	-	Res.	III
	Re	CP	Triadenum virginicum Marsh St. John's Wort	-	-	-	Res.	Res.	-	Res.	III
	Re	CP	Utricularia purpurea Purple Bladderwort	-	-	-	Res.	Res.	R in N.B.	Res.	III

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III

Species				Status							
(with common name, comments)				KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
			Pteretis pensylvanica Ostrich fern	R	R	R	-	-	-	-	III
	Re	CP	Rhyncospora capitellata f. discutiens Beak-rush	-	-	R	Res.	-	R	-	III
			Scheuchzeria palustris var. americana Scheuchzeria	R	R	R	Res.	-	-	-	III
	Re	CP	Sisyrinchium angustifolium Blue-eyed Grass	-	-	-	Res.	Res.	-	Res.	III
	Re	CP	Smilax rotundifolia Catbrier	-	-	-	Res.	Res.	Res.	-	III

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY III

Species (with common name, comments)				Status KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
	Re	CP	Woodwardia virginica Chain Fern	-	-	-	Res.	Res.	-	Res.	III
	Re	CP	Xyris caroliniana Yellow-eyed Grass	-	-	-	Res.	R	-	Res.	III

PRIORITY IV: Rare on 1 or 2 levels

			Botrychium multifidum Leathery Grape-fern	R	R	-	-	-	-	-	IV
			Calla palustris Wild Calla	R	R	-	-	-	-	–	IV
			Callitriche anceps Water-starwort	R	-	-	-	-	Abs.	-	IV
			Calopogon pulchellus Grass Pink	-	-	-	Res.	-	-	Res.	IV

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY IV

Species	Status							
(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
Carex arctata Sedge	R	R	-	-	-	-	-	IV
Carex atlantica Sedge	R	R	-	-	-	-	-	IV
Carex lupulina Sedge	R	R	-	-	-	-	-	IV
Habenaria lacera Ragged Fringed Orchid	R	-	-	-	-	-	-	IV
Malaxis unifolia Adder's Mouth	R	-	-	-	-	-	-	IV
Megalodonta beckii Water-marigold	R	-	-	-	-	-	-	IV

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY IV

			Species	Status							
			(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
			Muhlenbergia uniflora One-flowered Muhly Grass	R	-	-	-	-	-	-	IV
			Myriophyllum tenellum Water-milfoil	R	-	-	-	-	-	-	IV
			Phragmites communis Tall Reed Grass	R	R	-	-	-	-	-	IV
			Pogonia Ophioglossoides Rose Pogonia	-	-	-	-	Res.	-	Res.	IV
			Pyrola rotundifolia Round-leaved Pyrola	R	R	-	-	-	-	-	IV
			Rhyncospora capitellata Beak-rush	-	-	-	Res.	Res.	-	-	IV

Table F-6 (cont.) Priorized Species of Rare Status

PRIORITY IV

Species	Status							
(with common name, comments)	KNP	Local	Reg.	N.S.	Can.	Adj. St.	N.A.	Priority Rating
Satureja vulgaris var. neogaea Wild Basil	R	-	-	-	-	-	-	IV

PRIORITY SPECIES NEEDING VERIFICATION

PRIORITY II

Gnaphalium sylvaticum Cudweed -listed by Stanley et al, 1973; no specimen located.	R	R	R	-	-	R	-	II

Table F-7

Significant Forest Stands:

A number of forest stands in the Park are significant as:

1. representative examples of regional natural forest associations and/or successional stages; and
2. forest stands of scientific interest.

Table F-7 Significant Forest Stands (Numbers indicate locations on acc. map of Park)

Fig. F-5	Stand Description	Significance	Present Zoning and Management
A. CONIFEROUS STANDS			
1	Old growth Hemlock stand (ca. 81 ha.) North shore of Big Dam East Lake	-"superb stand of old-growth Hemlock" (Taschereau, 1974) -designated as International Biological Programme site -rare Park resource uncommon to rare in Acadian Forest Reg. -humus-bryophyte ground vegetation fragile when dry	-large part is Zone I, rest Zone II -trail, including loop trail along edge -campsites 1 and 3 in vicinity on lake shore
	Stand of mature Hemlock (ca. 16 ha.) (Buchanan et al, 1969) South side of lake	-representative of natural forest assn. in Atlantic Uplands Forest Region (AUFR)	-Zone II -campsite 2 in vicinity
2	Old-growth Hemlock stand Northwest of Dennis Boot Lake	-near-climax stand representative of rare seral stage -largest old-growth Hemlock in Park -good illustration of natural processes due to many windfalls in area	-Zone I -abandoned trail to area

Table F-7 (cont.) Significant Forest Stands

Fig. F-5	Stand Description	Significance	Present Zoning and Management
3	Mature Hemlock stands Cobrielle Lake Islands	-representative of natural forest assn. of AUFR -significant avifauna area	-Zone I -no development
4a to 4g	Mature Hemlock stands (Buchanan et al, 1969) a) Ell Island b) Hog Island - north part c) McLean Island - west half d) Dukeshire Island e) Hemlock Island f) Minard's Bay - southwest of (ca. 20 ha.) g) Grafton Lake - north of (ca. 20 ha.)	-a to f representative of natural forest assn. of AUFR -(g) in vicinity of Grafton Lake and Marsh (Zone I)	-(a) Zone III - campsite 14 -(b) to (f) Zone II wilderness area -(g) Zone III, natural environment.

Table F-7 (cont.) Significant Forest Stands

Fig. F-5	Stand Description	Significance	Present Zoning and Management
5	(a) Mature White Pine and Hemlock (ca. 55 ha) Southeast of Frozen Ocean Lake along Little River (b) Red and White Pine, and Hemlock (ca. 52 ha) (Buchanan et al, 1969) Both sides of Little River, south of Channel Lake.	-representative natural forest stands of AUFR.	-Zone II -wilderness area
6	Mature White and Red Pine (a) Lucifer Brook area (ca. 20 ha) (b) North of Luxton Lake (ca. 40 ha) Mature White Pine (c) South of Pebbleloggitch Lake (ca. 8 ha)	-representative natural forest stands of AUFR.	-Zone II -wilderness area
7	Pure stand of old Larch (Eastern Ecological Associates, 1975) Northwest River	-unique in Park	-Zone II -wilderness area -no access

Table F-7 (cont.) Significant Forest Stands

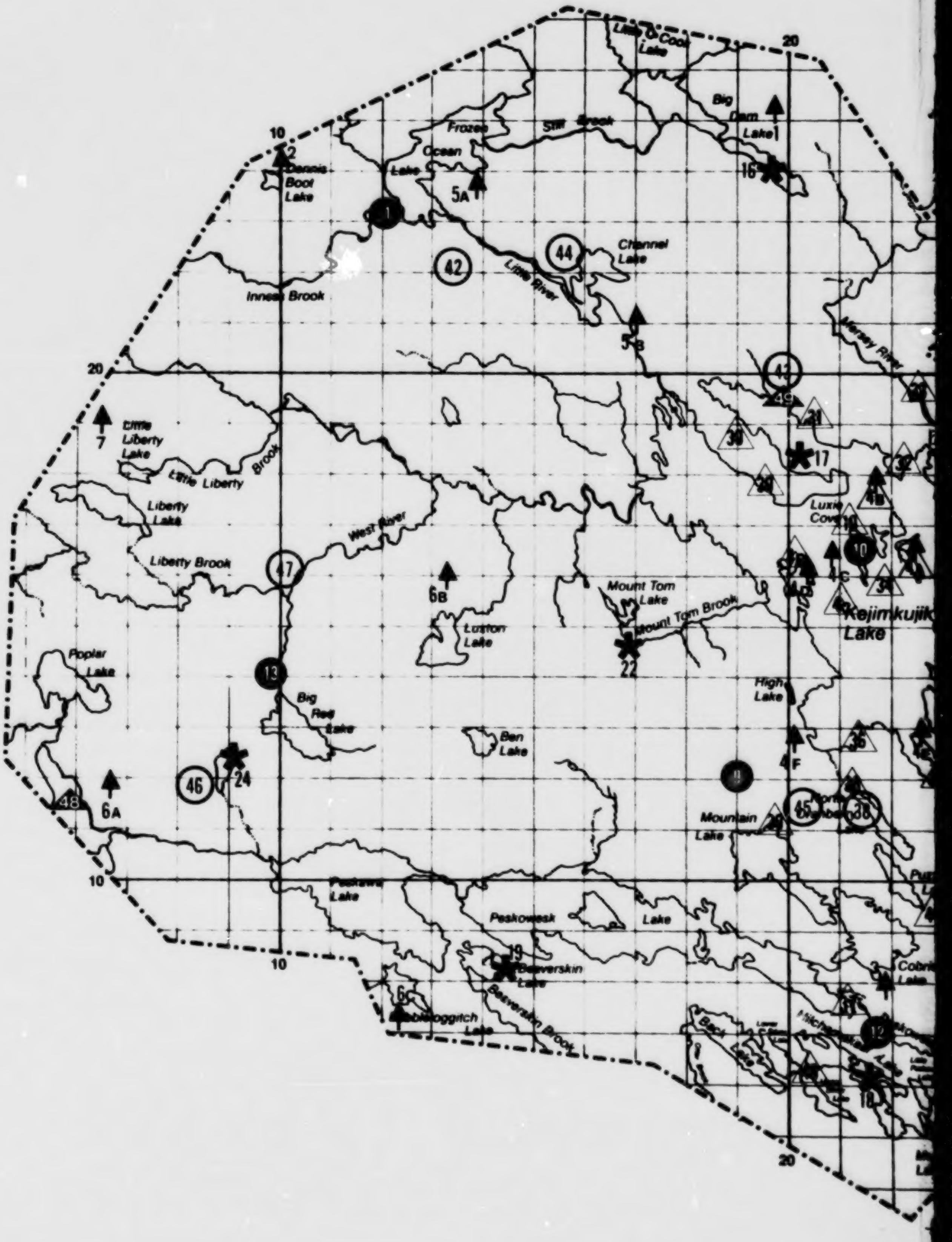
Fig. F-5	Stand Description	Significance	Present Zoning and Management
B. DECIDUOUS STANDS			
8	Old-growth Sugar Maple/White Ash/Beech stand (Stanley et al, 1973; Roland, 1976) Peale Island	-excellent example of rare near-climax seral stage -significant flora (Alleghenian species - Polygonatum pubescens, Actaea pachypoda) -Dryopteris ground cover rare in Park	-Zone I -access by water only
9	Old-growth Yellow Birch/Sugar Maple stand (Stanley et al, 1973) Fire Tower Hill	-significant seral stage - rare in Park -Dryopteris ground cover rare	-Zone II -access by road -road closed to vehicles from mid-June to mid-Sept.
10	Nearly mature stand of Sugar Maple/Yellow Birch/Beech Big Muise Island	-example of deciduous assn. in AUFR - rare in Park -Actaea pachypoda (A)	-Zone II -campsite 15 in vicinity

Table F-7 (cont.) Significant Forest Stands

Fig. F-5	Stand Description	Significance	Present Zoning and Management
C. FLOODPLAINS AND SWAMPS			
11	Mature Red Maple Floodplain Inness Brook area	-best example in Park of old-growth floodplain -fragile land form	-Zone I -access by water only
12	Red Maple glade Area 150 m. east of Peskowesk Brook bridge	-good example of Red Maple floodplain in west part of Park -rich flora of mosses and lichens (Roland, 1976) -Polygonum robustius, Woodwardia virginica (CP relic species)	-Zone I -campsite 28 east of bridge -access by road at northeast end -road closed to vehicles mid-June to mid-Sept.
13	Red Maple Swamp North of Big Red Lake around Red Lake Brook	-excellent representative example of Red Maple Swamp -only location in Park of Woodwardia aerolata (rare in N.S. and Canada) -Decodon verticillatus	-Zone I -bridge and trail through Woodwardia stand

Table F-7 (cont.) Significant Forest Stands

Fig. F-5	Stand Description	Significance	Present Zoning and Management
14	Rich intervale vegetation Mersey River Point, several 100 m. below Jake's Landing	-unique stand of rich intervale vegetation (Roland, 1980) -has best growth of *Smilax rotundifolia* in Park, CP relic species	-Zone III


20
Big Dam Lake
1
16
10
2
Dennis Boot Lake
Frozen Ocean Lake
Still Brook
5A
1
42
44
Channel Lake
Little River
Inness Brook
5B
Mersey River
20
43
49
21
30
17
7
Little Liberty Lake
Little Liberty Brook
Liberty Lake
39
Luxie Cove
10
West River
Liberty Brook
47
6B
Mount Tom Lake
Mount Tom Brook
4C
34
Kejimkujik Lake
Luxton Lake
22
Poplar Lake
13
Big Red Lake
High Lake
Ben Lake
35
4F
24
46
48
6A
45
38
Mountain Lake
29
10
10
Peskawa Lake
Peskowesk Lake
Lake
19
Beaverskin Lake
Beaverskin Brook
6C
Pebbleloggitch Lake
Back Lake
12
18
20

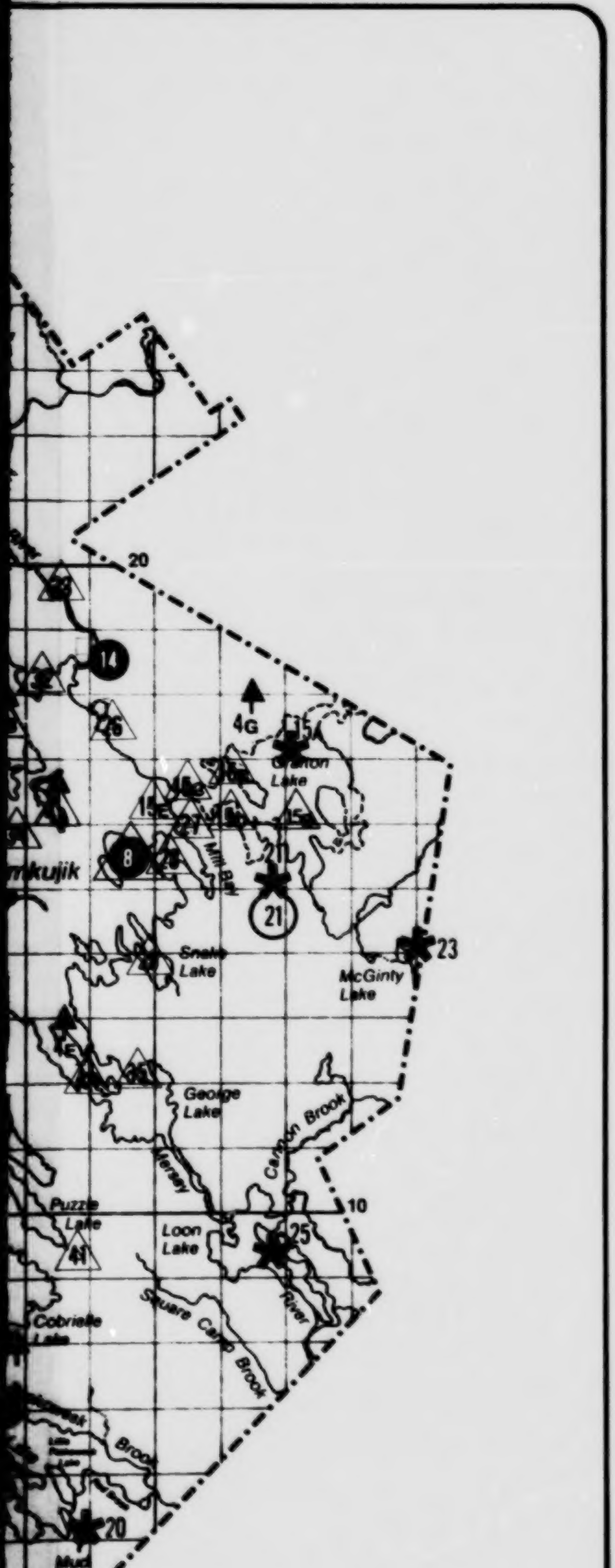

20
14
4G
15
Grafton Lake
15E
15B
26
27
28
Mill Brook
8
mkujik
21
23
Snake Lake
McGinty Lake
George Lake
Cannon Brook
Mersey
10
Puzzle Lake
Loon Lake
41
25
River
Cobrielle Lake
Square Camp Brook
Brook
20
Mud Lake

Figure F-5

Significant Forest Stands and Vegetation Associations

- ↑ Coniferous Stands
- ● Deciduous Stands
- □ Floodplains and Swamps
- ○ Bog Locations
- ▲ Fire Barrens
- ✱ Aquatic Locations
- △ Lakeshore Locations with Coastal Plain Flora and High Priority Species

See Table F-7 for explanation of numbers

Kejimkujik National Park

Parks Canada Atlantic Region

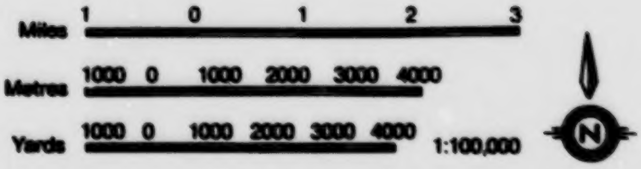

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Table F-8

Significant Non-Forest Vegetation Associations:

A number of locations of non-forest vegetation associations are significant as:

1. representative examples of certain natural habitats and/or processes of the Atlantic Uplands Forest Region uncommon or rare in the Park; and
2. habitats of Coastal Plain and Alleghenian flora .

Table F-8 Significant Non-Forest Vegetation Associations

Species listed under Significance are Priority I or II unless otherwise noted.

Numbers indicate locations on accompanying map of Park (Fig. F-5)

Fig. F-5	Location	Significance	Present Zoning and Management
A. AQUATIC			
15	Grafton Lake (cross-listed with lakeshore and marsh locations)	-representative of buffered nearly neutral clear lake (rare in Park) -25 species of aquatic macrophytes (Myriophyllum farwellii, Utricularia radiata).	-Zone I slate dam at exit of lake
16	Big Dam East Lake	-representative of neutral to slightly acidic lake (uncommon in Park) -32 species of aquatic macrophytes (Najas gracillima, M. farwellii, U. radiata) -along shores - Cephalanthus occidentalis, Alnus serrulata, Cyperus dentatus	-Zone II -portage Q at south end -campsite 2 on south side in most diverse area -both areas heavily used
17	Jeremy's Bay	-diverse aquatic flora (25 species) including 2 of the 4 stands of Hydrocotyle umbellata -best growth in Park of floating water plants	-Zone III -campground and swimming beach on north side of bay near stand of H. umbellata

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
18	Hilchemakaar Lake	-diverse aquatic flora (26 species) -*N. gracillima*, *Decodon verticillatus* and only known location of *Ceratophyllum echinatum* in N.S.	-Zone II -portages G and H at northwest end
19	Beaverskin Lake	-representative clear lake with deep-water *Sphagnum*-*Utricularia* association	-Zone II -portages K and L at northwest end
20	Mud Lake	-excellent example of succession in lakes (of scientific value) -*Isoetes acadiensis*, *D. verticillatus*, *Utricularia gibba*; *Dryopteris simulata*	-Zone II -isolated with no direct access -trail in vicinity
21	Little Kempton Lake (cross-listed with significant bogs)	-good example of early hydroseral succession	-Zone I -included with Grafton area ecosystem
22	Mount Tom Lake and Brook	-representative undeveloped aquatic ecosystem	-Zone II -isolated with no access

Table F-8 (cont.) Significant Non-Forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
23	McGinty Lake	-representative dark water slightly acidic lake -*U. radiata* -lakeshore is good orchid habitat	-Zone II -access by walking trail
24	Little Red Lake	-representative highly acidic shallow lake -8 macrophytes	-Zone II -access by walking trail -campsite 41 on northeast end
25	Loon Lake	-diverse aquatic flora (23 species) -*I. acadiensis*, *M. farwellii*, *C. occidentalis*; *Sisyrinchium atlanticum*	-Zone II -campsite 23 on island in lake

Table F-8 (cont.) Significant Non-Forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
B. LAKESHORE			
	Kejimkujik Lake - general	-"the peat, sand, gravel and cobble beaches together comprise the most significant habitat in KNP, in terms of species rare in N.S. and Can., and in terms of high quality habitat for coastal plain flora." (Roland, 1976)	-Lake is Zone III -eastern shore is Zone III and IV (campgrounds) with a few Zone I areas; extensive network of trails on north-east side -west shore is Zone II with no trails or roads
26	Fairy Bay and cove south of it	-coastal plain flora habitat (*C. occidentalis*, *H. umbellata*, *Panicum clandestinum*, *P. dichotomiflorum* var., *P. longifolium*; *Cyperus dentatus*, *Rhexia virginica*) -Alleghenian species *Desmodium canadense* (thr. in N.S.) -near archaeological site	-Zone I but fairly heavily used (guided walks and canoe trips to area)

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
27	East shore of Kejimkujik Lake (south of Fish Hatchery and opposite Peter Point)	-cove and swale significant as only known location of *Salix sericea* in Park (rare in N.S.)	-Zone I -no land access to area
28	Peter Point tip	-coastal plain flora habitat (*C. occidentalis*, *Alnus serrulata*, *P. longifolium*; *R. virginica*, *S. atlanticum*) -archaeological site	-Zone I -no land access to area
29	Snake Lake area -shore and bog	-good representative coastal plain flora habitat with species (Stanley *et al*, 1973; Roland, 1976) -*A. serrulata*, *C. occidentalis*, *Bartonia virginica*, *D. verticillatus*	-two sections are Zone I -rest is Zone II -loop trail to Snake Lake
30	Indian Point Peninsula -cove halfway up east side	-has best growth of floating water plants in Park including 1 of 4 stands of *H. umbellata*; also *U. radiata* -*A. serrulata* on shore nearby	-some of peninsula is Zone I -mostly Zone II

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
30	Indian Point Peninsula (cont.) -west side, north of Luxie Cove -mixed deciduous forest assn.	-*P. dichotomiflorum* var. (thr. in N.S.) -*R. virginica*, *C. dentatus* -ground cover *Dryopteris* assn. uncommon in Park, sensitive to impact -*Carex laxiflora* (only location in Park) -good representative of coastal plain flora habitat on many parts of shore (Roland, 1976, 1980) -archaeological site at tip and in Luxie Cove -possible use of base by Blanding's Turtle	-proposed wilderness campsite -trail at base, crossing from Jeremy's Bay to Little River -2 picnic sites
31	Meadow Campground Beach area	-rare coastal plain flora in vicinity (*H. umbellata* - 1 of 4 stands in Park) -*A. serrulata*, *P. longifolium* *U. subulata* -orchid habitat	-Zone IV -swimming beach

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
32	Kedge Beach on Jim Charles Point	-Alleghenian species *Desmodium canadense* (thr. in N.S.)	-Zone IV -garbage cans near stand
33	Mersey River Islands, above Jake's Landing	-best stand in Park of *Asclepias incarnata* var. (rare in Park and N.S.)	-Zone I -isolated except to canoeists
8	Peale Island (crosslisted with deciduous stands)	-*C. occidentalis*, *P. longifolium*, *U. subulata*; *R. virginica*, *S. atlanticum* -some Pr. III and Pr. IV species	-Zone I -isolated except to canoeists
4a	Ell Island (crosslisted with coniferous stands 4a to 4e)	-*P. longifolium*, *B. virginica*, *U. subulata*; *R. virginica* -some Pr. III and IV species	-Zone III -campsite 14
4b	Hog Island	-*A. serrulata*, *U. subulata*; *R. virginica*	-Zone II

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
4c	McLean Island	-B. virginica, C. occidentalis -has only stand in Park of Vaccinium corymbosum f. glabrum (not a priority species) -some Pr. III and IV species	-Zone I
4d	Dukeshire Island	-U. subulata, B. virginica, C. occidentalis; R. virginica -some Pr. III and IV species	-Zone II
4e	Hemlock Island	-C. occidentalis, P. longifolium, U. subulata; R. virginica - some Pr. III and IV species	-Zone II
10	Big Muise Island (crosslisted with deciduous stands)	-C. occidentalis, P. longifolium; Pr. II C. dentatus -some Pr. III and IV species	-Zone II -campsite 15
34	Three Sisters and Esker Island	-C. occidentalis, P. longifolium, U. subulata; R. virginica -stands of Cuscuta gronovii (rare in Park)(not a priority species) -significant avifauna area	-Zone I

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
35	George Lake -cove on northeast side -other parts of lakeshore	-H. umbellata -B. virginica, U. subulata; R. virginica -six Pr. III and 5 Pr. IV species around lake	-two areas of shore are Zone I -rest is Zone II -access by road and picnic area at southeast end
36	Minard's Bay	-D. verticillatus, P. longifolium, Carex howei; R. virginica, Dryopteris simulata	-Zone II -campsite 24 -portages A and E
15	Grafton Lake area a) lake - see aquatic location no. 15 b) lakeshore and marsh c) open woods d) Grafton Brook e) beach between mouth of Grafton Brook and Merrymakedge Beach	-"altogether the brook, the woods, the low area on the east side and the beach near the mouth, contain one of the richest concentrations of coastal plain species and rare plants in the Park." (Roland, 1976) -U. gibba; Pr. III species -significant habitats of rare avifauna -uncommon Dryopteris ground cover assn. -Desmodium glutinosum, Aster undulatus, Conopholis americana -rare moss (Thelia hirtella)	-Zone I -boardwalk crosses shallow bay on northwest shore of lake -trail along part of north shore -slate dam -road corridor -adjacent to heavily used swimming beach

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
15	Grafton Lake area (cont.)	-C. occidentalis (Pr. III species) -"one of the best sections along the whole east side of Kejimkujik Lake and should be preserved." (Roland, 1976) -P. dichotomiflorum var.; C. dentatus, R. virginica, S. atlanticum	
37	Peskowesk Lake area -at exit of Peskowesk Brook and peaty shore of cove to west, and point just west of portage G	-"best example of coastal plain habitat with species in western part of Park." (Roland, 1980) -U. subulata (large stand); D. simulata, C. dentatus, R. virginica -rare white-flowered form of Gratiola aurea (Pr. IV)	-Zone I in sensitive areas -Zone II in rest -Portages D and G in area -campsites 28 and 29 in area
38	North Cranberry Lake -north end (cross-listed with bogs)	-D. verticillatus, U. radiata; D. simulata, S. atlanticum	-Zone I in sensitive area -rest is Zone II -Portage A in Zone I area

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
39	Mountain Lake -northeast end	-*D. verticillatus* (large stand)	-Zone I -campsite 25 and portage E in area
40	Lower Silver Lake -southeast end	-*D. simulata* -Pr. III *Eleocharis robbinsii*	-Zone I -portage H and campsite 30 in area
41	Puzzle Lake -south end	-*D. verticillatus*	-Zone II -trail in vicinity
C. MARSH			
15b	Grafton Marsh (crosslisted with lakeshore)	-ecologically significant as part of Grafton ecosystem (habitats of rare flora, fauna, and avifauna)	-Zone I -trail and boardwalk along part of north shore

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
D. BOG			
42	Atkins Meadow	-excellent representative example of bog successional seres -only known location of *Schizaea pusilla*	-Zone I -no access
43	Heber Meadow	-example of mid to late bog succession -habitat of orchids (*Pogonia*, *Arethusa*, *Calopogon*, *Habenaria* spp.) -near stand of *H. umbellata* -area sensitive to impact -habitat of rare and endangered Blanding's Turtle	-Zone I -adjacent to Zone IV (Meadow Campground and Beach)
21	Little Kempton Lake (crosslisted with aquatic locations)	-example of early hydroseral succession -part of Grafton Lake ecosystem	-Zone I -no access
44	Channel Lake -north side	-large stand of *Scheuchzeria* (Pr. III) *Sphagnum* assn.	-Zone I -trail along south edge

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
45	Fire Tower Road Bog -west side between road and northeast end of Mountain Lake	-large stand of rare early seral stage of floating *Scheuchzeria*-*Sphagnum* assn. -orchids -*C. occidentalis*	-Zone II -access by road; closed to vehicles mid-June to mid-Sept.
46	Little Red Lake -west of	-uncommon *Scheuchzeria*-*Sphagnum* assn.	-Zone II -trail and campsite 41 on northeast side
47	Joe Tom Bog	-uncommon *Scheuchzeria*-*Sphagnum* assn.	-Zone II -trail along edge of bog
38	North Cranberry Lake -north end -crosslisted with lakeshores	-uncommon *Scheuchzeria*-*Sphagnum* assn.	-Zone I and II -portage A in Zone I

Table F-8 (cont.) Significant Non-forest Vegetation Associations

Fig. F-5	Location	Significance	Present Zoning and Management
E. FIRE BARRENS			
48	Lucifer Brook -south of	-1 of 2 locations in Park (Stanley *et al*, 1973)	-Zone II -isolated with no access
49	Heber Meadow -ride south of (beach ridge on Kejimkujik Lake)	-1 of 2 locations in Park -significant flora (*Corema conradii*, *Arctostaphylos uva-ursi* var. -habitat of Blanding's Turtle -sensitive to impact	-Zone I -Meadow Beach Campground and swimming area nearby

Resource Management Concerns:

1. Presently there is a need for plans dedicated to the development of appropriate management procedures for important plant species in Kejimkujik National Park. Such plans should be developed to insure effective protection strategies are formulated and implemented. Immediate consideration should be given to implementing protective measures for Priority I species including the following:
   a) *Hydrocotyle umbellata*, near Meadow Campground Beach;
   b) *H. umbellata*, *Panicum clandestinum*, *P. dichotomiflorum* var. and *Desmodium canadense*, near the petroglyph site in the cove south of Fairy Bay;
   c) *D. canadense* at the edge of Kedge Beach; and
   d) *P. dichotomiflorum* var. at the mouth of Grafton Brook near Merrymakedge Beach.

2. The phenomenon of acid rain has the potential to be detrimental to various significant plant species. Efforts should continue to reduce the cause of this problem at its source and to assess the present impact on the vegetation of Kejimkujik National Park.

3. It has been determined that the eastern shores of Kejimkujik Lake are important habitat for many coastal plain flora species. These areas tend to be the most heavily used by Park visitors. Care must be taken to ensure these unique and vulnerable habitats are appropriately protected from human impact.

4. A number of exotic plant species have been introduced to the area including Kejimkujik National Park. Where appropriate and feasible, exotic species should be removed to ensure native species are protected from displacement.

5. To maintain diversity in plant populations and thus preserve significant flora it has been shown that sufficient suitable habitat and an adequate gene pool are essential (Pielou, 1975). If a species is destroyed in a given area, the location may never be recolonized if the nearest station is sufficiently far away. It is therefore necessary in Kejimkujik to develop an appropriate gene pool management strategy for important plant species to insure they are sufficiently protected from extirpation.

Research Requirements:

1. It is recommended that field studies and data compilation to support a plant management plan for priority species be carried out along guidelines prepared by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

2. There is a lack of knowledge of vegetational relationships in the various forest types in the Park (Stanley et al, 1973). A classification system which more accurately defines cover types and the influences upon them should be developed to facilitate resource management planning.

It is recommended that existing information about lichens and bryophytes be verified and expanded through field collections and analysis.

4. It is recommended that a species list for fungi with maps of locations of rare and significant species be prepared.

5. Research to complete steps II and III of the priorization of rare species should be carried out. This involves the study of:
   a) stability of habitat;
   b) habitat sensitivity;
   c) extent of critical habitat;
   d) future threats to population; and
   e) occurrence in another National Park. (Step II)

   and

   a) reproductive trends;
   b) population structure; and
   c) species uniqueness. (Step III)

6. There is a lack of information concerning ground flora (vascular bryophytes, lichens and fungi) in the various forest stands in the Park. It is recommended that further study occur to facilitate effective resource evaluation and protection.

Recommendations for Management:

1. Based on the priorization of plant species in this document, and subsequent analysis and mapping of significant vegetation, it is recommended that the Park zoning system be revised to reflect the protecting needs for important vegetation in Kejimkujik National Park.

2. The Red Maple glade along Peskowesk Brook represents the best example of its type in the western part of the Park. It is an unstable area rich in mosses and lichens. A road passes nearby and a campsite is located in the vicinity. It is recommended that a management plan be prepared for the area to define the requirements for appropriate protection.

3. The Red Maple swamp around Red Lake Brook at the north end of Big Red Lake is a significant representative area, and the only known location in the Park of Woodwardia aerolata (rare in Nova Scotia and Canada). A trail and foot-bridge pass through the stand. It is recommended that a management plan be prepared for the area to define the requirements for improved protection.

4. On the north side of Big Dam (East) Lake a trail passes through a stand of old growth Hemlocks. Two campsites are also situated in the vicinity. This area has been assigned a Zone 1 classification and is designated as an International Biological Programme site to be utilized as a benchmark and for scientific study. The impact of the trail and campsites should be assessed regularly to determine the existence of adverse effects on the stand.

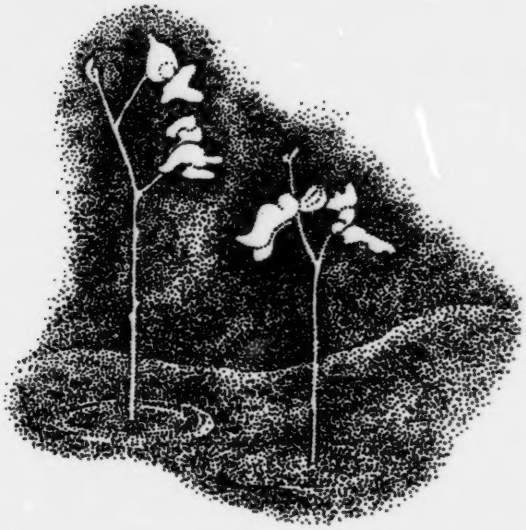
5. A unique stand of rich intervale vegetation on the Mersey River point near Jake's Landing is presently classified as a Zone III area. Considering its vulnerability to erosion and trampling impact, its zoning should be re-evaluated to insure protection is appropriate.

Opportunities:

Relic plant species in Kejimkujik National Park are significant for scientific research and nature interpretation because they are often relatively accessible yet characteristic of distant places. Thus, for example, the process of evolution can be evaluated through examination of rare disjunct stands. Opportunities for scientific research also include study of a possible correlation between extent and distribution of deep-water Sphagnum-Utricularia associations and the acidification of lakes as caused by improper land use practices and the long range transplant of air pollutants. Unique and representative softwood, hardwood, and mixed wood forest stands in Kejimkujik offer the opportunity for research into natural forest ecology, including the status of forest insect pests, response to environmental acidification on different soil types and as a potential source of high quality seed stock.

Limitations:

Some rare and relic plant species are found in small fragile stands and habitats (e.g. Hydrocotyle umbellata). Use of these areas by visitors and researchers should be carefully controlled using appropriate zoning or other management techniques. Beach-shoreline habitats are especially sensitive along with marsh and bog habitat. Trampling and soil compaction to the detriment of plant species can occur as a result of human disturbance. Care should be taken to design visitor facilities (trails, campsites, etc.) in such a manner as to avoid more sensitive stands of vegetation such as those on a wet substrate or with vulnerable shallow root systems (some softwood stands).



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Appendix F-1 Mosses (Listed Alphabetically)

	Comments
Amblystegiella subtilis (Hedw.) Loeske	
Anomodon minor (Hedw.) Fürnr.	
A. rostratus (Hedw.) Schimp.	
A. rugelii (C.M.) Keissl.	Rare
Atrichum altecristatum (Ren. & Card.) Irel.	
Aulacomnium androgynum (Hedw.) Schwaegar.	
A. palustre (Hedw.) Schwaegar.	
Brachythecium albicans (Hedw.) Bry. Eur.	
B. campestre (C. M.) B S G	
B. salebrosum (Web. & Mohr).	
B. starkei (Brid.) B S G	
Brotherella recurvans (Mx.) Fl.	
Bryum pseudotriquetrum (Hedw.) Gärtn., Meyer & Scherb.	
Buxbaumia aphylla Hedw.	Rare
Ceratodon purpurea (Hedw.) Brid.	
Callicladium haldanianum (Grev.) Crum	
Campylium stellatum (Hedw.) C. Jens.	
Climacium dendroides (Hedw.) Web. & Mohr.	
Drepanocladus aduncus (Hedw.) Warnst.	
D. exannulatus (Guemb.) Warnst.	
D. fluitans (Hedw.) Warnst.	
D. sendtneri (Schimp.) Warnst.	
Dichelyma capillaceum (With.) Myr.	
Dicranum condensatum Hedw.	Rare
D. drummondii C. Mull.	
D. flagellare Hedw.	
D. fulvum Hook.	
D. fuscescens Turn.	
D. montanum Hedw.	Rare
D. polysetum Hedw.	

Appendix F-1 (cont.) Mosses (Listed Alphabetically)

	Comments
Dicranum scoparium Hedw.	
D. undulatum Brid. (restricted to *Osmunda*-*Myrica* assn.)	
D. viride (Sull. & Lesq. ex Sull.) Lindb.	
Diphyscium foliosum (Hedw.) Mohr	
Ditrichum pallidum (Hedw.) Hampe	
Eurhynchium hians (Hedw.) J. & S.	
E. pulchellum (Hedw.) Jenn.	
Fontinalis antipyretica Hedw.	
F. dalecarlica Bry. Eur.	
F. disticha Hook. & Wils. ex Drumm.	
F. novae-angliae Sull.	
Funaria hygrometrica Hedw.	
Grimmia alpicola Hedw.	
G. angusteum ? (See Roland 1980, p. 31)	
G. olneyi Sull.	Rare
Hedwigia ciliata (Hedw.) P. Beauv.	
Herzogiella striatella (Brid.) Iwats.	
H. turfacea (Brid.) Iwats.	
Hylocomium splendens (Hedw.) B S G	
Hypnum crista-castrensis Hedw.	
H. cupressiforme Hedw.	
H. curvifolium Hedw.	
H. imponens Hedw.	
H. pallescens (Hedw.) P. Beauv.	
Isopterygium tenerum (Sw.) Mitt. (*Osmunda*-*Myrica* assn.)	Rare
Leptobryum pyriforme (Hedw.) Wils.	
Leptodictyum trichopodium var *kochii* (BSG) Broth.	
Leucobryum glaucum (Hedw.) Angstr. ex Fr.	

Appendix F-1 (cont.) Mosses (Listed Alphabetically)

	Comments
Mnium cinclidioides Hüb.	
M. cuspidatum Hedw.	
M. hornum Hedw.	
M. punctatum Hedw.	
M. riparium Mitt.	Rare
Neckera complanata (Hedw.) Hueben	
N. pennata Hedw.	
Philonotis marchia (Hedw.) Brid.	
Plagiomnium ciliare (C. Mull.) Kop.	
P. cuspidatum (Hedw.) Kop.	
Plagiothecium laetum BSG	
P. pulchellum (Hedw.) B. & S.	
P. striatellum (Brid.) Lindb.	
P. turfaceum (Lindb.) Lindb.	
Platygyrium repens (Brid.) BSG	Rare
Pleurozium schreberi (Brid.) Mitt.	
Pogonatum alpinum (Hedw.) Röhl.	
P. urnigerum (Hedw.) Par.	
Pohlia nutans (Hedw.) Lindb.	
Polytrichum commune Hedw.	
P. commune var *perigoniale* (Michx.) BSG	
P. juniperinum Hedw.	
P. ohioense Ren. & Card.	
P. piliferum Hedw.	
P. strictum Menz. ex Brid.	
Pterigynandrum filiforme Hedw.	
Rhacomitrium aciculare (Hedw.) Brid.	
Rhizomnium appalachianum Kop.	
Sciaromium lescurii (Sull.) Broth.	

Appendix F-1 (cont.) Mosses (Listed Alphabetically)

	Comments
Sphagnum centrale C. Jens.	
S. compactum DC	
S. cuspidatum Ehr. ex Hoffm.	
S. cuspidatum var *torreyanum* (Sull.) Braithw.	
S. fallax (Klinggr.) Klinggr. (*S. recurvatum* P. Beauv.)	
S. fimbriatum Wils. ex Hook.	Rare
S. flavicomans (Card.) Warnst.	
S. fuscum (Schimp.) Klinggr.	
S. girgensohnii Prss.	
S. macrophyllum Bernh. ex Brid.	
S. magellanicum Brid.	
S. majus (Russ.) C. Jens. (*S. dusenii* C. Jens.)	
S. nemoreum Scop. (*S. capillaceum* (Weiss.))Schr.	
S. palustre L.	
S. pulchrum (Lindb. ex Braithw.) Warnst.	
S. pylaesii Brid.	
S. robustum (Russ.) Roll. (*S. russowii* Warnst.)	
S. rubellum Wils.	
S. strictum Sull.	
S. subsecundum var *platyphyllum* (Lindb. ex Braithw.) Card. (*S. platyphyllum*)	
S. tenellum (Brid.) Pers. ex Brid.	
Tetraphis pellucida Hedw.	
Thelia hirtella (Hedw.) Sull.	CP Species
Thuidium delicatulum (Hedw.) BSG	
T. philiberti Limpr.	Rare
T. recognitum (Hedw.) Lindb.	
Tremadon ambiguens (Hedw.) Hornsch.	
Ulota crispa (Hedw.) Brid.	
U. hutchinsiae (Sm.) Hamm. (*Polypodium* assn.)	
U. ludwigii Brid.	Rare

Appendix F-2 Liverworts (Listed Alphabetically)

Leafy Liverworts:

	Comments
Barbilophosia hatcheri (Evans) Loeske	
Bazzania trilobata (L.) S.F. Gray	Common
Calypogeia muelleriana (Schiffn) K. Muller	
Cephalozia bicuspidata (L.) Dumort.	
C. connivens (Dicks.) Lindb.	
C. media Lindb.	Common in *Osmunda-Myrica* assn.
Cladopodiella fluitans (Nees) Buch	Common in *Osmunda-Myrica* assn.
Frullania asagrayana Mont.	
F. eboracensis Gottsche	Common on trees
Gymnocolea inflata (Huds.) Dumort.	Common in bogs
Jungermannia lanceolata L.	Common
J. pumila With.	
Lepidozia reptans (L.) Dumort.	Common
Lophocolea minor Nees	
Microlepidozia setacea (Web.) Joerg.	Restricted to bogs
Mylia anomola (Hook.) S. F. Gray	Common in bogs
Nardia geoscyphus (DeNot.) Lindb.	
N. scalaris (Schrad.) S. F. Gray	
Nowellia curvifolia (Dicks.) Mitt.	Common in woods
Plectocolea crenulata (*Solenostoma gracillimum* (Smith) Schuster)	
Porella platyphylloidea (Schwein.) Lindb.	Common
Ptilidium ciliare (L.) Nees	Uncommon
P. pulcherrimum (Web.) Hampe	
Radula complanata (L.) Dumort.	
Scapania undulata (L.) Dumort.	Common in woodlands
Tricholea tomentella (Ehrh.) Dumort.	

Appendix F-2 (cont.) Liverworts (Listed Alphabetically)

Thallose Liverworts:

	Comments
Fossombronia cristula Aust.	
F. foveolata Lindb.	
Marchantia polymorpha L.	
Pallavicinia lyellii (Hook.) S. F. Gray	Common in *Osmunda-Myrica* assn.
Pellia epiphylla (L.) Corda	Common

Appendix F-3 Lichens (Listed Alphabetically)

Alectoria americana Motyka
A. nidulifera Norrl.
Anaptychia palmulata (Michx.) Vain
Anzia colpodes (Ach.) Stizenb.
Arthonia radiata (Pers.) Ach.
Aspicilia cinerea (L.) Korb.
Baeomyces roseus Pers.
Buellia stillingiana J. Stein
Cetreria ciliare Ach.
C. halei W. Culb. and C. Culb.
Cetreria chicitae (Culb.) Culb. & Culb.
Cladonia alpestris (L.) Rabenh.
C. amaurocrea (Floerke) Schaer.
C. arbuscula (Wallr.) Rabenh.
C. bacillaris (Ach.) Nyl.
C. caespiticia (Pers.) Floerke
C. carneola (Fr.) Fr.
C. cenotea (Ach.) Schaer.
C. chlorophaea (Flke. in Somm.) Spreng.
C. coniocraea (Flörke) Spreng.
C. cornuta (L.) Hoffm.
C. crispata (Ach.) Flot.
C. cristatella Tuck.
C. floerkiana (Fr.) Flörke)
C. furcata (Huds.) Schrad.
C. gracilis (L.) Willd.
C. grayi
C. incrassata Florke
C. maxima (Asah.) Ahti, ined.
C. mitis Sandst.
C. nemomyxa (Ach.) Nyl.

Appendix F-3 (cont.) Lichens (Listed Alphabetically)

Cladonia pleurota (Flörke) Schaer.
C. pyxidata (L.) Hoffm.
C. rangiferina (L.) Wigg.
C. rei Schaer.
C. scabriuscula (Duby) Leight.
C. squamosa (Scop.) Hoffm.
C. stellaris (Opiz.) Brod.
C. terrae-novae Ahti (*C. subtenius* (Abb.) Evans)
C. uncinialis (L.) Wigg.
C. verticillata Hoffm.
Collema subfurvum (Müll. Arg.) Degel.
Dermatocarpon miniatum (L.) Mann
Evernia mesomorpha Nyl.
Graphis scripta (L.) Ach.
Haemostomma ochrophaeum (Tuck.) Mass.
Hypogymnia physodes (L.) Nyl.
H. tubulosa (Schaer.) Hav.
Ichmodophila ericetorum (L.) Zahl.
Lasallia papulosa (Ach.) Llano
Lecanora caesiorubella Ach. subsp. *lathamii*
L. caesiorubella Imsh. & Brodo ssp. *caesiorubella*
L. chlarona (Ach.) Nyl.
L. cinerea (L.) Somm.
L. cinereofusca Magn.
L. glabrata (Ach.) Malme
L. pseudochlarotera Brodo
Lecidea albocaerulescens (Wulf. in Jacq.) Ach.
L. berengeriana (Mass.) Nyl.
Lepraria sp.
Leptogonium cyanescens (Ach.) Körb.

Appendix F-3 (cont.) *Lichens (Listed Alphabetically)*

Lobaria pulmonaria (L.) Hoffm.
L. quercizans Michx.
L. scrobiculata (Scop.) DC
Ochrolechia androgyna (Hoffm.) Arn.
Parmelia caperata (L.) Ach.
P. cumberlandia (Gyeln.) Hale
P. olivacea (L.) Ach.
P. rudecta Ach.
P. squarrosa Hale
P. sulcata Tayl.
Peltigera aphthosa (L.) Willd.
P. canina (L.) Willd.)
P. elizabethae Gyeln.
P. horizontalis (Huds.) Baumg.
Pertusaria amara (Ach.) Nyl.
P. multipuncta (Turn.) Nyl.
P. Pertusa (L.) Tuck.
P. velata (Turn.) Nyl.
Phaeophyscia rubropulchra (Degel.) Moburg
Platismatia norvegica (Lynge) Culb. & Culb.
P. tuckermanni (Oakes) W. Culb. & C. Culb.
Pseudocyphallaria crocata (L.) Vain
Pyrenula nitida (Weig.) Ach.
Pyxine sorediata (Ach.) Mont. in Sagra
Ramalina calcicaris (L.) Fr.
R. minuscula (*R. pollinariella* Nyl.)
Sarcogyne privigna (Ach.) Mass.
S. regularis Körb.
Stereocaulon cfr. *depreaultii* Del.
Trypethelium virens Tuck. in W. Darl.

Appendix F-3 (cont.) Lichens (Listed Alphabetically)

Umbilicaria mammulata Tuck.
U. muhlenbergii (Ach.) Tuck.
U. papulosa (Ach.) Nyl. (*LaSallia papulosa* (Ach.) Llano)
Usnea angulata Ach.
U. cavernosa Tuck.
U. comosa (Ach.) Ach.
U. fulvoreagens (Räs.) Räs.
U. longissima (L.) Ach.
U. mutabilis Stirt.
U. strigosa (Ach.) A. Eat.
U. trichodea Ach.

Appendix F-4 Vascular Plants of Kejimkujik National Park

KEY

R	Rare
OC	Occasional
F	Frequent
C	Common
I	Introduced

Appendix F-4 Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Adder's Mouth, Green	*Malaxis unifolia*	R	
Agrimony	*Agrimonia striata*	OC	
Alder, Downy	*Alnus crispa*	OC	
Alder, Smooth (Green)	*Alnus serrulata*	R	
Alder, Speckled	*Alnus rugosa*	C	
Alfalfa	*Medicago sativa*	I	
Apple	*Pyrus malus*	OC	I
Arethusa; Dragon's Mouth	*Arethusa bulbosa*	R	
Arrow-head	*Sagittaria latifolia*	C	
Arrow-head, Narrow-leaved	*Sagittaria graminea*	R-OC	
Ash, Black	*Fraxinus nigra*	OC	
Ash, Mountain	*Sorbus americana*	R	
Ash, White	*Fraxinus americana*	OC	
Aspen, Large-toothed	*Populus grandidentata*	C	
Aspen, Trembling	*Populus tremuloides*	OC	
Aster	*Aster borealis*	C	
Aster	*Aster novi-belgii*	C	
Aster, Bog	*Aster nemoralis*	C	
Aster, Calico	*Aster lateriflorus*	C	
Aster, Large-leaved	*Aster macrophyllus*	C	
Aster, Tall White	*Aster umbellatus*	C	
Aster, Tradescant's	*Aster tradescanti*	C	
Aster, Wavy-leaved	*Aster undulatus*	R	
Aster, Whorled Wood	*Aster acuminatus*	C	
Baneberry, White	*Actaea pachypoda*	R	
Barnyard Grass	*Echinochloa crusgalli*	R	I
Basil Weed	*Satureja vulgaris* var *neogaea*	R	
Bayberry	*Myrica pensylvanica*	C	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Beak-rush	*Rhynchospora fusca*	C
Beak-rush	*Rhynchospora capitellata*	F
Beak-rush	*Rhynchospora capitellata* f. *discutiens*	OC
Beak-rush	*Rhynchospora alba*	C
Bearberry	*Arctostaphylos uva-ursi* var *coactilis*	R-OC
Beard-tongue	*Pentstemon digitalis*	I
Bedstraw, Fragrant	*Galium triflorum*	OC
Bedstraw, Marsh	*Galium palustre*	C
Bedstraw, Madder	*Galium tinctorium*	OC
Beech, American	*Fagus grandifolia*	F-C
Beech-drops	*Epifagus virginiana*	OC
Beggar's Ticks, Common	*Bidens frondosa*	C
Bentgrass, Common	*Agrostis tenuis*	C
Bentgrass, Woodland	*Agrostis perennans*	C
Bindweed	*Polygonum cilinode*	OC
Birch, White (Paper or Canoe)	*Betula papyrifera*	C
Birch, Wire (Grey, Old Field)	*Betula populifolia*	C
Birch, Yellow	*Betula alleghaniensis* (*lutea*)	OC
Black Medick	*Medicago lupulina*	I
Black-eyed Susan	*Rudbeckia serotina*	C
Blackberry	*Rubus recurvicaulis*	OC
Blackberry	*Rubus pensilvanicus*	OC
Blackberry	*Rubus allegheniensis*	OC
Blackberry	*Rubus adjacens*	OC
Blackberry, Trailing	*Rubus hispidus*	C

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Bladderwort	*Utricularia radiata*	R
Bladderwort	*Utricularia geminiscarpa*	C
Bladderwort, Flat-leaved	*Utricularia intermedia*	OC
Bladderwort, Greater	*Utricularia vulgaris*	C
Bladderwort, Horned	*Utricularia cornuta*	C
Bladderwort, Humped	*Utricularia gibba*	R
Bladderwort, Purple	*Utricularia purpurea*	F
Bladderwort, Small	*Utricularia subulata*	OC-f(res)
Blue-eyed Grass	*Sisyrinchium montanum* var *crebrum*	OC
Blue-eyed Grass	*Sisyrinchium atlanticum*	R-OC
Blue-eyed Grass	*Sisyrinchium angustifolium*	OC
Blue-joint	*Calamagrostis pickeringii*	OC
Blue-joint	*Calamagrostis canadensis*	C
Blueberry	*Vaccinium brittonii*	OC
Blueberry, Canada or Velvet-leaf	*Vaccinium myrtilloides*	OC
Blueberry, Common	*Vaccinium angustifolium*	C
Blueberry, Highbush	*Vaccinium corymbosum forma glabrum*	R
Bluegrass, Canada	*Poa compressa*	C I
Bluegrass, Kentucky	*Poa pratensis*	C I
Bluegrass, Wood	*Poa nemoralis*	I
Bog Rosemary	*Andromeda glaucophylla*	OC
Boneset	*Eupatorium perfoliatum*	OC
Brome Grass, Wild	*Bromus ciliatus*	R
Broom, Scotch	*Cytisus scoparius*	R I
Buckthorn	*Rhamnus frangula*	R I
Buckthorn	*Rhamnus alnifolia*	OC

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Bugle Weed	Lycopus uniflorus	OC
Bulrush	Scirpus rubrotinctus	OC
Bulrush	Scirpus cyperinus	C
Bulrush	Scirpus cespitosus	OC
Bulrush	Scirpus atrovirens	C
Bulrush, Great	Scirpus validus	OC
Bulrush, Water; Swaying Rush	Scirpus subterminalis	F
Bunchberry	Cornus canadensis	C
Bur-reed	Sparganium americanum	C
Bur-reed	Sparganium chlorocarpum	OC
Bur-reed	Sparganium fluctuans	OC
Bur-reed, Narrow-leaved	Sparganium angustifolium	C
Burdock	Arctium minus	OC I
Buttercup, Creeping	Ranunculus repens	OC I
Buttercup, Tall	Ranunculus acris	OC I
Buttonbush	Cephalanthus occidentalis	OC-f(res)
Calopogon; Grass-pink	Calopogon pulchellus	OC
Calla, Wild	Calla palustris	R
Carrot, Wild	Daucus carota	C I
Cat-brier	Smilax rotundifolia	OC (res)
Cattail, Broad-leaved	Typha latifolia	C
Chain-fern, Dwarf	Woodwardia areolata	R
Chain-fern, Virginia	Woodwardia virginica	F
Cherry, Black	Prunus serotina	OC
Cherry, Choke	Prunus virginiana	OC
Cherry, Pin (Fire, Bird)	Prunus pensylvanica	OC

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Chickweed, Field	*Cerastium arvense*	OC	
Chickweed, Mouse-Ear	*Cerastium vulgatum* var. *hirsutum*	OC	
Chokeberry, Purple	*Aronia prunifolia*	C	
Chokeberry, Red	*Aronia arbutifolia*	OC	
Cinquefoil	*Potentilla recta* var. *sulphurea*	OC	I
Cinquefoil, Rough	*Potentilla norvegica*	OC	
Cinquefoil, Small Yellow	*Potentilla simplex* var. *calvescens*	C	
Cinquefoil, Marsh	*Potentilla palustris*	R	
Cleavers; Wild Madder	*Galium mullugo*	OC	I
Clintonia; Blue Bead Lily	*Clintonia borealis*	C	
Clover, Alsike	*Trifolium hybridum*	I	
Clover, Least Hop	*Trifolium dubium*	I	
Clover, Red	*Trifolium pratense*	C	I
Clover, Small Hop	*Trifolium procumbens*	I	
Clover, White	*Trifolium repens*	C	I
Clover, Yellow Hop	*Trifolium agrarium*	C	I
Clubmoss	*Lycopodium tristachyum*	C	
Clubmoss, Bog	*Lycopodium inundatum*	OC	
Clubmoss, Large Bog	*Lycopodium inundatum* var. *bigelovii*	OC-F	
Clubmoss, Bristly	*Lycopodium annotinum*	OC	
Clubmoss, Fan-leaved	*Lycopodium flabelliforme*	OC	
Clubmoss, Shining	*Lycopodium lucidulum*	OC	
Clubmoss, Trailing; Running Pine	*Lycopodium clavatum*	OC	
Clubmoss; Ground Cedar	*Lycopodium complanatum*	OC	
Clubmoss; Ground Pine	*Lycopodium obscurum*	C	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Coltsfoot	*Tussilago farfara*	OC	I
Coral-root, Early	*Corallorhiza trifida* var *verna*	OC	
Coral-root, Spotted	*Corallorhiza maculata*	C	
Corydalis, Pale or Pink	*Corydalis sempervirens*	OC	
Cotton-grass	*Eriophorum virginicum*	C	
Cotton-grass	*Eriophorum tenellum*	C	
Cotton-grass	*Eriophorum spissum*	OC	
Cotton-grass	*Eriophorum angustifolium*	C	
Couch-grass	*Agropyron repens*	I	
Cow Parsnip	*Heracleum lanatum*	OC	I
Cow-wheat	*Melampyrum lineare*	C	
Cranberry, Large	*Vaccinium macrocarpon*	C	
Cranberry, Small	*Vaccinium oxycoccus*	C	
Cress, Bitter	*Cardamine pensylvanica*	R	
Crowberry, Black	*Empetrum nigrum*	OC	
Crowberry, Broon	*Corema conradii*	R	
Cuckoo Flower	*Cardamine pratensis*	OC	
Cudweed	*Gnaphalium sylvaticum*	R	
Cudweed	*Gnaphalium macounii*	OC	
Cut-grass, Rice	*Leersia oryzoides*	C	I
Daisy, Ox-eye	*Chrysanthemum leucanthemum*	C	
Dalibarda; Dewdrop	*Dalibarda repens*	C	
Dandelion	*Taraxacum officinale*	OC	I
Dandelion, Fall	*Leontodon autumnalis*	C	I
Dandelion, Red-Seeded	*Taraxacum erythrospermum*	OC	I
Dewberry	*Rubus pubescens*	C	
Dock, Blunt-leaved	*Rumex obtusifolius*	OC	I

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Dock, curled	Rumex crispus	OC	I
Dodder, Common	Cuscuta gronovii	OC	
Dogbane, Spreading	Apocynum androsaemifolium	C	
Dogwood, Alternate-leaved	Cornus alternifolia	OC	
Dogwood, Red Osier	Cornus stolonifera	R	
Dwarf Mistletoe	Arceuthobium pusillum	OC	
Elder, Common	Sambucus canadensis	OC	
Enchanger's Nightshade	Circaea quadrisulcata var canadensis	OC	
Enchanger's Nightshade, Small	Circaea alpina	OC	
Evening-primrose	Oenethera biennis	OC	
Eyebright, Common	Euphrasia americana	OC	
Fern, Beech	Dryopteris phegopteris	C	
Fern, Bog	Dryopteris simulata	OC	
Fern, Bracken	Pteridium aquilinum	C	
Fern, Christmas	Polystichum acrostichoides	C	
Fern, Cinnamon	Osmunda cinnamomea	C	
Fern, Crested	Dryopteris cristata	OC	
Fern, Curly-grass	Schizaea pusilla	R	
Fern, Hay-scented	Dennstaedtia punctilobula	C	
Fern, Intermediate Wood	Dryopteris intermedia	C	
Fern, Interrupted	Osmunda claytoniana	C	
Fern, Lady	Athyrium filix-femina var michauxii	C	
Fern, Marginal Wood	Dryopteris marginalis	C	
Fern, Marsh	Dryopteris thelypteris	C	
Fern, New York	Dryopteris noveboracensis	C	
Fern, Oak	Dryopteris disjuncta	OC	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Fern, Ostrich	Pteretis pensylvanica	R
Fern, Royal	Osmunda regalis	C
Fern, Sensitive	Onoclea sensibilis	C
Fern, Spinulose Wood	Dryopteris spinulosa	C
Fescue Grass, Hair	Festuca capillata	OC
Fescue Grass, Meadow	Festuca elatior	OC I
Fescue Grass, Red	Festuca rubra	C
Fir, Balsam	Abies balsamea	C
Fireweed; Large Willow-herb	Epilobium angustifolium	R
Fleabane, Daisy	Erigeron strigosus	OC
Floating-heart	Nymphoides cordata	F-C
Foxtail Grass	Hordeum jubatum	C
Foxtail, Meadow Grass	Alopecurus pratensis	I
Galingale	Cyperus dentatus	OC
Geranium, Wild	Geranium bicknellii	R
Giant Reed Grass	Phragmites communis	R-OC
Golden Saxifrage	Chrysosplenium americanum	OC
Golden-pert	Gratiola aurea	F
Goldenrod, Bog	Solidago uliginosa var linoides	OC
Goldenrod, Canada	Solidago canadensis	C
Goldenrod, Downy	Solidago puberula	C
Goldenrod, Old-field or Gray	Solidago nemoralis	C
Goldenrod, Narrow-leaved	Solidago graminifolia	C
Goldenrod, Rough-stemmed	Solidago rugosa	C

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Goldenrod, Silver	*Solidago bicolor*	C	
Goldenrod, Slender-leaved	*Solidago galetorum*	F	
Goldthread	*Coptis trifolia*	C	
Grape-fern, Leathery	*Botrychium multifidum*	R	
Grass, Rattlesnake	*Glyceria laxa*	R	
Grass, Cord	*Spartina pectinata*	C	
Grass, Orchard	*Dactylis glomerata*	C	I
Grass, Tickle	*Agrostis scabra*	OC	
Grass, Velvet	*Holcus lanatus*	I	
Groundnut	*Apios americana*	OC-F	
Hair Grass	*Deschampsia flexuosa*	C	
Hawkweed	*Hieracium piloselloides*	C	I
Hawkweed	*Hieracium lachenalii*	C	I
Hawkweed	*Hieracium caespitosum*	OC	I
Hawkweed, Mouse-ear	*Hieracium pilosella*	C	I
Hawkweed, Native	*Hieracium paniculatum*	R	
Hawkweed, Rough	*Hieracium scabrum*	OC	
Hawkweed, Smoothish; King Devil	*Hieracium floribundum*	C	I
Hawkweed; Devil's Paint Brush	*Hieracium aurantiacum*	OC	I
Hawthorn, American	*Crataegus macrosperma*	OC	
Hawthorn, English	*Crataegus monogyna*	R	I
Hazelnut	*Corylus cornuta*	C	
Heal-all	*Prunella vulgaris*	OC	I
Hemlock, Eastern	*Tsuga canadensis*	C	
Hemp-nettle	*Galeopsis tetrahit*	OC	I
Hobblebush	*Viburnum alnifolium*	OC	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Hog-peanut	*Amphicarpa bracteata*	OC
Holly, Canada	*Ilex verticillata*	C
Holly, False	*Nemopanthus mucronata*	OC
Honeysuckle, American Fly	*Lonicera canadensis*	OC
Honeysuckle, Bush	*Diervilla lonicera*	OC
Hornwort	*Ceratophyllum demersum*	OC
Hornwort	*Ceratophyllum echinatum*	R
Horsetail, Field	*Equisetum arvense*	OC
Horsetail, Water	*Equisetum fluviatile*	C
Horsetail, Woodland	*Equisetum sylvaticum*	OC
Huckleberry	*Gaylussacia baccata*	C
Huckleberry, Bog	*Gaylussacia dumosa* var *bigeloviana*	OC
Indian Cucumber-Root	*Medeola virginiana*	C
Indian Hemp	*Apocynum cannabinum* var *hypericifolium*	OC
Indian Pipe	*Monotropa uniflora*	C
Indian-tobacco	*Lobelia inflata*	C
Inkberry	*Ilex glabra*	F
Iris; Blue Flag	*Iris versicolor*	OC
Ironwood (Hop Hornbeam)	*Ostrya virginiana*	R
Joe-pye-weed	*Eupatorium maculatum*	OC
Juneberry; shadbush	*Amelanchier bartramiana*	OC
Juneberry; Shadbush	*Amelanchier lucida*	OC
Juneberry; Shadbush	*Amelanchier laevis*	OC

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Juniper, Ground	*Juniperus communis* var *depressa*	OC
Knapweed	*Centaurea nigra*	OC I
Labrador Tea	*Ledum groenlandicum*	C
Lady's Slipper	*Cypripedium acaule*	C
Lady's Thumb; Redleg	*Polygonum persicaria*	I
Lady's Tresses, Nodding	*Spiranthes cernua*	C
Lady's Tresses, Northern Slender	*Spiranthes lacera (gracilis)*	OC
Larch; Tamarack	*Larix laricina*	C
Larch; Tamarack	*Larix decidua*	OC I
Laurel, Pale	*Kalmia polifolia*	OC
Laurel, Sheep; Lambkill	*Kalmia angustifolia*	C
Leatherleaf	*Chamaedaphne calyculata*	C
Lettuce, Wild	*Lactuca canadensis*	OC
Lily-of-the-Valley, Wild	*Maianthemum canadense*	C
Lion's Paw	*Prenanthes trifoliolata*	OC
Loosestrife	*Lysimachia terrestris*	C
Loosestrife, Purple	*Lythrum salicaria*	R I
Loosestrife, Swamp	*Decodon verticillatus* var *laevigatus*	OC
Manna-grass, Obtuse	*Glyceria obtusa*	OC
Manna-grass, Fowl	*Glyceria striata*	C
Manna-grass, Northern	*Glyceria borealis*	OC
Manna-grass, Small	*Glyceria fernaldii*	OC

Appendix F-4 (cont.) The Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Maple, Red	Acer rubrum	C
Maple, Red	Acer rubrum var trilobum	OC
Maple, Striped	Acer pensylvanicum	C
Maple, Sugar	Acer saccharum	OC
Meadow Grass	Poa palustris	C
Meadow Grass, Rough-stalked	Poa trivialis	R I
Meadow-beauty	Rhexia virginica	OC-F(Res)
Meadow-rue	Thalictrum polygamum	C
Meadowsweet	Spirea latifolia	C
Milkweed, Swamp	Asclepias incarnata var	R
Mint, Field	Mentha arvense var villosa	OC
Miterwort	Mitella nuda	R
Muhly Grass, One-flowered	Muhlenbergia uniflora	R-OC
Mullein	Verbascum thapsus	OC I
Musk-mallow	Malva moschata	OC I
Naiad	Najas gracillima	R
Naiad	Najas flexilis	R
Nighshade, Bitter-sweet	Solanum dulcamara	OC I
Oak, Red	Quercus borealis	C
Orchid, Fringed	Habenaria clavellata var ophioglossoides	OC
Orchid, Fringed White	Habenaria blephariglottis	OC
Orchid, Hooker's Fringed	Habenaria hookeri	R
Orchid, Ragged Fringed	Habenaria lacera	R

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Panic Grass	Panicum capillare	I	
Panic Grass	Panicum boreale	C	
Panic Grass	Panicum subvillosum	R-OC	
Panic Grass	Panicum spretum	C	
Panic Grass	Panicum lanuginosum	C	
Panic Grass	Panicum lanuginosum var septentrionale	R	
Panic Grass	Panicum dichotomiflorum var puritanorum	R	
Panic Grass	Panicum depauperatum	C	
Panic Grass, Large	Panicum clandestinum	R	
Panic Grass, Long-leaved	Panicum longifolium	C	
Panic Grass; Switch-grass	Panicum virgatum var spissum	C	
Partridgeberry	Mitchella repens	C	
Pearlwort	Sagina procumbens	C	
Pearly Everlasting	Anaphalis margaritacea	OC	
Pickerel-weed	Pontederia cordata	F	
Pilewort; Fireweed	Erechtites hieracifolia	OC	
Pine, Red	Pinus resinosa	OC	
Pine, Scotch	Pinus sylvestris	R	
Pine, White	Pinus strobus	C	
Pine-sap	Monotropa hypopithys	OC	
Pink, Deptford	Dianthus armeria	OC	I
Pinweed	Lechea intermedia	OC	
Pipewort	Eriocaulon septangulare	F-C	
Pitcher-plant	Sarracenia purpurea	C	
Plantain, Broad-leaved	Plantago major	OC	I
Plantain, English; Rib-grass	Plantago lanceolata	OC	I

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Poison Ivy	*Toxicodendron radicans* subsp *radicans*	C
Poison Ivy	*Toxicodendron radicans* var *rydbergii*	C
Polypody, Rock	*Polypodium virginianum*	C
Pond-lily, Cow or Yellow	*Nuphar variegatum*	C
Pond-lily, Snail	*Nuphar microphyllum*	R-OC
Pondweed	*Potamogeton berchtoldii*	C
Pondweed	*Potamogeton epihydrus* var *nuttallii*	C
Pondweed	*Potamogeton confervoides*	C
Pondweed	*Potamogeton spirillus*	R
Pondweed	*Potamogeton natans*	R
Pondweed	*Potamogeton oakesianus*	OC
Pondweed, Small	*Potamogeton pusillus* var *pusillus*	OC
Prince's Pine	*Chimaphila umbellata*	C
Pussy Toes	*Antennaria canadensis*	C
Pussy Toes	*Antennaria petaloidea* var *subcorymbosa*	C
Pyrola, One-flowered	*Moneses uniflora*	OC
Pyrola, Round-leaved	*Pyrola rotundifolia*	R
Quillwort	*Isoetes macrospora*	F
Quillwort	*Isoetes tuckermani*	C
Quillwort	*Isoetes acadiensis*	R
Raspberry, Wild	*Rubus strigosus*	OC
Rattlesnake Grass	*Glyceria canadensis*	C
Rattlesnake-plantain	*Goodyera tesselata*	OC-F
Red-top Grass	*Agrostis alba*	I

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Reed Canary Grass	*Phalaris arundinacea*	I
Rhodora	*Rhododendron canadense*	C
Rice Grass	*Oryzopsis asperifolia*	C
Rose	*Rosa palustris*	OC
Rose Pogonia	*Pogonia ophioglossoides*	OC
Rose, Common Wild	*Rosa virginiana*	OC
Rose, Swamp	*Rosa nitida*	C
Rush	*Juncus secundus*	OC
Rush	*Juncus pelocarpus*	C
Rush	*Juncus militaris*	C
Rush	*Juncus filiformis*	C
Rush, Canada	*Juncus canadensis*	C
Rush, Common	*Juncus effusus* var *solutus*	OC
Rush, Short-caudate	*Juncus brevicaudatus*	C
Rush, Slender	*Juncus tenuis*	C
Rush, Toad	*Juncus bufonius*	C
Sandwort, Grove	*Arenaria lateriflora*	OC I
Sarsaparilla, Bristly	*Aralia hispida*	OC
Sarsaparilla, Wild	*Aralia nudicaulis*	C
Scheuchzeria	*Scheuchzeria palustris*	R-OC
Screwstem	*Bartonia virginica*	R
Screwstem	*Bartonia paniculata*	R-OC(res)
Sedge	*Carex atlantica*	R-OC
Sedge	*Carex argyrantha*	C
Sedge	*Carex arctata*	R
Sedge	*Carex aenea*	OC
Sedge	*Carex lacustris*	R
Sedge	*Carex intumescens*	OC

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
Sedge	*Carex howei*	R
Sedge	*Carex houghtonii*	C
Sedge	*Carex folliculata*	OC
Sedge	*Carex disperma*	C
Sedge	*Carex deweyana*	C
Sedge	*Carex debilis* var *rudgei*	C
Sedge	*Carex cumulata*	OC
Sedge	*Carex crinita*	C
Sedge	*Carex crinita* var *minor*	C
Sedge	*Carex crawfordii*	C
Sedge	*Carex communis*	C
Sedge	*Carex canescens* var *disjuncta*	OC
Sedge	*Carex bullata*	F-C
Sedge	*Carex brunnescens* var *sphaerostachya*	C
Sedge	*Carex vulpinoidea*	C
Sedge	*Carex vesicaria*	OC
Sedge	*Carex vesicaria* var *monile*	OC
Sedge	*Carex trisperma*	C
Sedge	*Carex trisperma* var *billingsii*	C
Sedge	*Carex tribuloides*	C
Sedge	*Carex stricta*	C
Sedge	*Carex stipata*	C
Sedge	*Carex scoparia*	OC
Sedge	*Carex rostrata* var *utriculata*	C
Sedge	*Carex projecta*	C

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Sedge	*Carex pensylvanica* var *distans*	OC	
Sedge	*Carex paupercula*	OC	
Sedge	*Carex pallescens* var *neogaea*	R	
Sedge	*Carex oligosperma*	C	
Sedge	*Carex novae-angliae*	C	
Sedge	*Carex muricata*	C	
Sedge	*Carex lurida*	C	
Sedge	*Carex lupulina*	R	
Sedge	*Carex leptonervia*	C	
Sedge	*Carex lenticularis*	C	
Sedge	*Carex lenticularis* var *blakei*	C	
Sedge	*Carex laxiflora*	R	
Sedge	*Carex lasiocarpa* var *americana*	OC	
Sheep-sorrel	*Rumex acetosella*	I	
Shepherd's Purse	*Capsella bursa-pastoris*	OC	I
Shinleaf	*Pyrola elliptica*	OC	
Short-husk Grass, Bearded	*Brachyelytrum erectum*	C	
Skullcap, Mad-dog	*Scutellaria lateriflora*	OC	
Skullcap, Marsh	*Scutellaria galericulata*	C	
Smartweed	*Polygonum dubium*	R	I
Smartweed	*Polygonum robustius*	R	
Smartweed, Water	*Polygonum natans (amphibium)*	R	
Smartweed, Water	*Polygonum natans* f. *hartwrightii*	OC	
Smartweed; Knotweed	*Polygonum scabrum*	I	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Snakeroot, Black	*Sanicula marilandica*	OC	
Snowberry, Creeping	*Gaultheria hispidula*	OC	
Solomon's Seal, Downy	*Polygonatum pubescens*	R	
Solomon's Seal, False	*Smilacina racemosa*	OC	
Solomon's Seal, Three-leaved False	*Smilacina trifolia*	OC	
Spearmint	*Mentha spicata*	OC	I
Spearwort, Creeping	*Ranunculus reptans* (*flammula* var *filformis*)	C	
Speedwell, Bird's-eye	*Veronica chamaedrys*	R	I
Speedwell, Common	*Veronica officinalis*	OC	
Speedwell, Thyme-leaved	*Veronica serpyllifolia*	C	I
Spike-rush	*Eleocharis smallii*	C	
Spike-rush	*Eleocharis robbinsii*	R	
Spike-rush, Blunt	*Eleocharis obtusa*	C	
Spike-rush, Needle	*Eleocharis acicularis*	C	
Spruce, Black	*Picea mariana*	C	
Spruce, Norway	*Picea abies*	R	I
Spruce, Red	*Picea rubens*	C	
Spruce, White	*Picea glauca*	C	
Spurrey	*Spergula arvensis*	C	I
Squawroot; Cancer-root	*Conopholis americana*	R	
St. John's Wort	*Hypericum boreale*	OC	
St. John's Wort, Common	*Hypericum perforatum*	C	
St. John's Wort, Small	*Hypericum mutilum* var *parviflorum*	C	
St. John's Wort, Marsh	*Triadenum fraseri*	C	
St. John's Wort, Marsh	*Triadenum virginicum*	F	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS
St. John's Wort, Canadian	Hypericum canadense	C
Star-flower	Trientalis borealis	C
Starwort, Lesser; Stichwort	Stellaria graminea	C I
Starwort, Northern	Stellaria calycantha	OC
Steeplebush	Spirea tomentosa	C
Strawberry, Wild	Fragaria virginiana	C
Sumach, Staghorn	Rhus typhina	OC
Sundew, Narrow-leaved	Drosera intermedia	C
Sundew, Round-leaved	Drosera rotundifolia	OC
Sundrops	Oenothera perennis	OC
Sweet Cicely	Osmorhiza claytoni	R-OC
Sweet Gale	Myrica gale	C
Sweet Vernal Grass	Anthoxanthum odoratum	C
Sweet-fern	Comptonia peregrina	C
Tansy	Tanacetum vulgare	OC I
Thistle, Bull	Cirsium vulgare	I
Thistle, Swamp	Cirsium muticum	OC
Three-way Sedge	Dulichium arundinaceum	C
Tick-clover, Pointed-leaved	Desmodium glutinosum	R
Tick-clover, Showy	Desmodium canadense	R
Timothy	Phleum pratense	I
Touch-me-not, Spotted	Impatiens capensis	OC
Trailing Arbutus; Mayflower	Epigaea repens var glabrifolia	C
Trefoil, Bird-foot	Lotus corniculatus	OC I
Trillium, Painted	Trillium undulatum	C
Turtlehead	Chelone glabra	OC
Twayblade	Listera cordata	OC

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Twig-rush	*Cladium mariscoides*	C	
Twinflower	*Linnaea borealis* var *americana*	C	
Twisted-stalk	*Streptopus roseus* var *perspectus*	OC	
Vetch, Common	*Vicia angustifolia*	I	
Vetch, Four-seeded	*Vicia tetrasperma*	OC	I
Vetch, Tufted	*Vicia cracca*	C	I
Violet, Lance-leaved	*Viola lanceolata*	C	
Violet, Marsh Blue	*Viola cucullata*	C	
Violet, Northern Blue	*Viola septentrionalis*	C	
Violet, Northern Downy	*Viola fimbriatula*	OC	
Violet, Small White	*Viola pallens*	OC	
Violet, White Wood	*Viola incognita*	C	
Virginia Creeper	*Parthenocissus quinquefolia*	I	
Water Lily	*Nymphaea odorata*	C	
Water Parsnip	*Sium suave*	C	
Water Pennywort	*Hydrocotyle umbellata*	R	
Water-horehound	*Lycopus americanus*	C	
Water-lobelia	*Lobelia dortmanna*	C	
Water-marigold	*Megalodonta* (*Bidens*) *beckii*	R	
Water-milfoil	*Myriophyllum tenellum*	R-OC	
Water-milfoil	*Myriophyllum farwellii*	R-OC	
Water-pepper	*Polygonum hydropiper*	C	
Water-pepper, Mild	*Polygonum hydropiperoides*	OC	
Water-purslane	*Ludwigia palustris* var *americana*	R-OC	
Water-shield	*Brasenia schreberi*	F-C	
Water-starwort	*Callitriche anceps*	OC	
Waterwort	*Elatine minima*	OC	

Appendix F-4 (cont.) Vascular Plants of Kejimkujik National Park

COMMON NAME	LATIN NAME	STATUS	
Willow, Beaked	*Salix bebbiana*	OC	
Willow, Bog	*Salix pyrifolia*	OC	
Willow, Pussy	*Salix discolor*	OC	
Willow, Silky	*Salix sericea*	R	
Willow, Small Pussy	*Salix humilis*	C	
Willow-herb	*Epilobium adenocaulon*	R	
Willow-herb	*Epilobium palustre*	OC	
Willow-herb, Bog	*Epilobium leptophyllum*	OC	
Willow-herb, Downy	*Epilobium strictum*	OC	
Wintergreen, Green-flowered	*Pyrola virens forma paucifolia*	OC	
Wintergreen, One-sided	*Pyrola secunda*	OC	
Wintergreen; Teaberry	*Gaultheria procumbens*	C	
Wire Grass	*Danthonia compressa*	C	
Wire Grass; Wild Oat Grass	*Danthonia spicata*	C	
Witch-hazel	*Hamamelis virginiana*	C	
Witherod	*Virburnum cassinoides*	F	
Wood Sorrel, Common	*Oxalis montana*	C	
Wood Sorrel, Yellow	*Oxalis stricta*	OC	
Wood-reed Grass	*Cinna latifolia*	OC	
Woodrush	*Luzula multiflora*	C	
Woodrush	*Luzula acuminata*	OC	
Woodrush, Introduced	*Luzula luzuloides*	R	I
Yarrow	*Achillaea lanulosa*	OC	
Yarrow	*Achillaea millefolium*	C	I
Yellow Rocket	*Barbarea vulgaris*	OC	I
Yellow-eyed Grass	*Xyris montana*	OC	
Yellow-eyed Grass	*Xyris caroliniana*	F	
Yellow-rattle	*Rhinanthus crista-galli*	OC	
Yew, Canada	*Taxus canadensis*	OC	

INVERTEBRATES

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Description:

Kejimkujik National Park supports a numerous and diverse invertebrate fauna. However, relatively little work dealing with invertebrates has been done in the Park. Those studies that have taken place have looked at very specific sections of the Park's invertebrate fauna in specific habitats. Consequently there are large gaps in the knowledge of the Park's invertebrate fauna.

Studies that have taken place to date include work by Lane et al (1981, 1982) dealing with aquatic invertebrates, Clair (1982) dealing specifically with Chronomids (Class: Insecta), Peterson et al (1983) dealing with fish but listing invertebrate food species, Knox (1981) listing all macroinvertebrates found in three lakes in the Park, and Drysdale (1980) discussing stream ecology as it relates to environmental acidification in Nova Scotia. With the exception of a light trap, operated jointly by the Canadian Forestry Service and the Park Natural Resource Conservation Section, there have been no studies of terrestrial invertebrates in Kejimkujik National Park. The light trap results are used in the identification and monitoring of forest pest species of the Order: Lepidoptera, Superfamilies Macrolepidoptera and Microlepidoptera (Class: Insecta). Consequently only species from these two groups are identified in the annual summaries provided to the Park by the Canadian Forestry Service. Other insect species caught at the trap are ignored by this study. Furthermore when the trap was first operational (in 1970) all trapped moths were identified and listed in the annual summaries. Currently only the most important species are recorded (L.P. Magasi, pers. comm.).

Table G-1 is a synthesis of the data from all of the above sources. For the purposes of simplification the various classes of invertebrates are summarized to the level of Order only, although in the individual studies organisms were identified to the species level. Also given are approximate figures for Nova Scotia (Maritimes Resource Management Service, 1983) for each group of invertebrate. Since the knowledge of the invertebrate fauna of both the Park and the province is incomplete, true comparisons of numbers of species should not be attempted at this time.

Table G-2 is a list of all invertebrate species identified by the various studies conducted in Kejimkujik National Park. The table is incomplete as a list of all species occurring in the Park and is subject to considerable future additions.

Evaluation:

Since relatively little quantitative research has been done on the Park's invertebrate fauna it is not possible at this time to determine areas or habitats critical to Park species.

Management Objectives:

1. To gather data on Park invertebrate populations to determine species composition, distribution and status, and to identify environmental and human influences on these populations.

2. To identify and monitor invertebrate species status inside Park boundaries, and to develop management strategies where necessary and desirable.

3. To identify and protect habitats or species rare or threatened in the Park and/or in Nova Scotia.

Table G-1 Approximate Numbers of Species of Invertebrates Occurring in Kejimkujik National Park Compared With Approximate Numbers for Nova Scotia (Land and Fresh-water Habitats Only)

Group		Approximate Numbers of Species	
		K.N.P.	N.S.
Protozoa		-	?
Porifera		-	2
Coelenterata		1	1
Platyhelminthes	Turbellaria	1	2
	Trematoda	-	?
	Cestoda	-	2
Rotifera		8	17
Nematoda		-	?
Nematomorpha		-	1
Annelida	Oligochaeta	10	15
	Hirudinea	1	19
Mollusca	Gastropoda	1	80
	Pelecypoda	1	18
Diplopoda		-	6
Chilopoda		-	1
Arachnida		2	1500
Crustacea		39	60+
Insecta	Hemiptera	1	1500
	Coleoptera	2	3000
	Lepidoptera	295	2000
	Diptera	9	3000
	Hymenoptera	-	2500
	all other orders	43	1000

Table G-2 Invertebrate Species Identified as Occurring in Kejimkujik National Park

(After Knox, 1981; Lane *et al*, 1981; Forest Insect and Disease Survey, 1970-1984.)

- Phylum Coelenterata
  - Class Hydrozoa
    - Order Hydroidea
      - Family Hydridae
        - *Hydra* sp.

- Phylum Platyhelminthes (Flatworms)
  - Class Turbellaria
    - Order Tricladida
      - Family Planariidae (Planarians)
        - *Dugesia tigrina*

- Phylum Rotifera
  - Class Monogonta
    - Order Plioma
      - Family Brachionidae
        - *Kellicottia bostoniensis* Rousselet
        - *Keratella cochlearis* Gosse
        - *Euchlanis* sp.
      - Family Synchaetidae
        - *Polyartra vulgaris* Carlin
        - *Ploesoma hudsoni* Imhof
      - Family Trichocercidae
        - *Trichocerca elongata* Gosse
      - Family Asplanchnidae
        - *Asplanchna* sp.
    - Order Flosculariacae
      - Family Conochilidae
        - *Conochilus unicornis* Rousselet

Table G-2 (cont.)

Phylum Annelida	(segmented Roundworm)
Class Oligochaeta	
Order Lumbriculida	
Family Lumbriculidae	
Lumbriculus sp.	(Earthworms)
Order Haplotaxina	
Family Enchytraeidae	
Enchytraeus sp.	
Lumbricillus sp.	
Family Naididae	(Aquatic worms)
Nais sp.	
Stylaria fossularis	
S. lacustris	
Pristina sp.	
Slavina sp.	
Paranais sp.	
Allonais sp.	
Class Hirudinea	(Leeches)
Order Rhynchobdellida	
Family Glossiphoniidae	
Placobdella ornata	
Phylum Mollusca	
Class Gastropoda	(Snails)
Order Basommatophora	
Ferrissia sp.	
Class Pelecypoda	(Mussels)
Order Heterodonta	
Sphaerium sp.	
Phylum Arthropoda	(Spiders and Ticks)
Class Arachnica	
Order Acarina	
Family Ixodidae	

Table G-2 (cont.)

- Family Ixodidae (cont.)
  - Dermacentor variabilis
- Family Hydrachnellidae
  - Neumania sp.

Class Crustacea

- Order Cladocera
  - Family Leptodoridae
    - Leptodora kindtii Focke
  - Family Polyphemidae
    - Polyphemus pediculus L.
  - Family Sididae
    - Sida crystallina
    - Diaphanosoma brachyurum Lieven
    - D. leuchtenbergianum Fisher
    - Latonopsis sp.
    - Latona setifera O.F.M.
  - Family Holopedidae
    - Holopedium gibberum Zaddach
  - Family Daphnidae
    - Daphnia ambigua Scourfield
    - D. catawba Coker
    - Scapholeberis sp.
    - Ceriodaphnia sp.
  - Family Bosminidae
    - Bosmina longirostris O.F.M.
    - Eubosmina longispina Leydig
    - E. tubicen Brehm
  - Family Chydoridae
    - Alonella excisa Fischer
    - A. pulchella Sars
    - Acroperus sp.
    - Alona intermedia Sars
    - A. affinis Leydig
    - A. rustica Baird

Table G-2 (cont.)

A. guttata Sars
A. rectangula Sars
Chydorus cf. brevilabris Teach
C. bicornutus Doolittle
C. piger Sars
C. linguilabris Teach
Camptocercus rectirostris Schodler
Eurycercus lamellatus O.F.M.
Family Macrothricidae
Ophryoxus gracilis Sars
Parophryoxus tubulatus
Acantholeberis curcirostria
Order Copepoda
Family Temoridae
Epischura nordenskioldi Lillj.
Family Diaptomidae
Diaptomus minutus Lillj.
D. oregonensis Lillj.
Family Cyclopidae
Mesocyclops edax Forbes
Tropocyclops sp.
Order Isopoda
Family Asellidae
Asellus communis
Order Amphipoda
Family Talitridae
Hyalella azteca
Class Insecta (Insects)
Order Collembola (Springtails)
Family Entomobryidae
Isotoma sp.
Family Sminthuridae
Bourlethella spinata

Table G-2 (cont.)

- Order Ephemeroptera (Mayflies)
  - Family Ephemeridae
    - *Hexagenia limbata*
  - Family Heptageniidae
    - *Stenonema* sp.
  - Family Baetidae
    - *Siphlonurus alternatus*
    - *Caenis* sp.
    - *Ephemerella minimella*
    - *E. temporalis*
    - *Leptophlebia* sp.
    - *Paraleptophlebia* sp.
- Order Odonata (Dragonflies and Damselflies)
  - Family Gomphidae
    - *Gomphus* sp.
    - *Octogomphus* sp.
    - *Arigomphus* sp.
  - Family Aeshnidae
    - *Anax* sp.
  - Family Libelluidae
    - *Neurocordulia* sp.
    - *Tetragoneura* sp.
    - *Plathemis* sp.
    - *Libellula* sp.
    - *Leucorrhina* sp.
    - *Ladona* sp.
    - *Sympetrum* sp.
    - *Paltothemis* sp.
  - Family Lestidae
    - *Lestes* sp.
  - Family Coenagrionidae
    - *Enallagma* sp.
    - *Ariga* sp.

Table G-2 (cont.)

- Order Plecoptera (Stoneflies)
  - Family Perlidae
    - *Paragnetina* sp.
    - *Perlinella* sp.
  - Family Isoperlidae
    - *Isoperla* sp.
    - *Hastaperla brevis*
- Order Hemiptera (True Bugs)
  - Family Corixidae
    - *Corisella* sp.
- Order Neuroptera (Lacewings and Dobsonflies)
  - Family Corydalidae
    - *Chauliodes* sp.
  - Family Sialidae
    - *Sialis* sp.
- Order Coleoptera (Beetles and Weevils)
  - Family Dytiscidae
    - *Deronectes* sp.
  - Family Psephenidae
    - *Psephenus* sp.
- Order Trichoptera (Caddisflies)
  - Family Hydroptilidae
    - *Oxyethira* sp.
    - *Agrylea* sp.
  - Family Phryganeidae
    - *Agrypnia* sp.
    - *Oligostomis* sp.
  - Family Limnephilidae
    - *Asynarchus* sp.
  - Family Psychomiidae
    - *Polycentropus* sp.
    - *Neuroclipsis* sp.
    - *Phylocentropus* sp.

Table G-2 (cont.)

Family Molannidae

Molanna flavicornis

Family Brachycentridae

Oligoplectrum sp.

Family Leptoceridae

Oecetis sp.

Family Helicopsychidae

Helicopsyche sp.

Order Lepidoptera (Moths and Butterflies)

(the following list is a compilation of the lists of identified moths taken from the Park's light trap)

Abagrotis alternata
Abbottana clemataria
Acronicta afflicta
A. americana
A. dactalina
A. fragilis
A. funeralis
A. grisea
A. haesitata
A. impleta
A. impressa
A. inclara
A. innotata
A. laetifica
A. leporina
A. lithospila
A. morula
A. noctivaga
A. oblinita
A. radcliffii
A. retardata
A. sperata
A. tritona

Actias luna
Adita chionanthi
Aethalura anticaria
Agriopodes fallax
Agroperina cogitata
Agrotis mollis
A. venerabilis
A. volubilis
A. ypsilon
Amathes bicarnea
A. c-nigrum
A. normaniana
A. oblata
Amphipoea americana
Amphipyra pyramidoides
Anacamptodes larvaria
Anagoga occiduaria
Anaplectoides prasina
A. pressus
Anavitrinella pampinaria
Anaytus privata
Anisota virginiensis
Anomogyna dilucida

Table G-2 (cont.)

Order Lepidoptera (cont.)

Anomogyna elimata
A. imperita
A. perquirita
Antheraea polyphemus
Antepione thisouria
Apamea amputatrix
A. lignicolora
Apantesis parthenice
A. virguncule
A. virgo
Apharetra dentata
Aplectoides condita
Archippus albertus
A. cerasivoranus
Archips argyrospilus
Autographa ampla
A. bimaculata
A. mappa
Baileya dormitans
B. doubledayi
Besma quercivoraria
Biston cognateria
Bleptina caradrinalis
Bomolocha baltimoralis
B. palparia
Coenargina crassiuscula
Calpe canadensis
Campaea perlata
Capis curvata
Caripeta angustiorata
C. divisata
C. piniata
Catocala antingmpha
C. coccinata
C. connubialis
C. relicta
C. sordida
Cenopis pettitana
Ceratomia undulosa
Cerura modesta
Charadra deridens
Choristoneura conflictana
C. fumiferana
C. pinus pinus
C. rosaceana
Chrysanympha formosa
Chrysaspidia putnami
Chytonix palliatricula
Colocasia propinquilinea
Cosmia canescens f. *calamia*
Crocigrapha normani
Croesia semipurpurana
Cryptocala acadiensis
Ctenucha virginica
Cyclophora pendulinaria
Darapsa pholus
Dasylophia thyatiroides
Datana ministra
Deuteronomos magnarius
Diacrisia virginica
Dioryetria sp.
Drepana arcuata
D. bilineata

Table G-2 (cont.)

Order Lepidoptera (cont.)

- *Dryocampa rubicunda rubicunda*
- *Elaphria festivoides*
- *E. versicolor*
- *Ennomos magnarius*
- *E. subsignarius*
- *Epicnaptera americana*
- *Epizeuxis aemula*
- *E. americalis*
- *Estigmene congrua*
- *E. prima*
- *Euchlaena johnsonaria*
- *E. muzaria*
- *Eucirrhoedia pampina*
- *Eueretagrotis attenta*
- *Eufidonia discospilata*
- *Euherrichia monetifera*
- *Eurois astricta*
- *E. occulata*
- *Feltia geniculata*
- *F. herilis*
- *Gluphisia avimacula*
- *G. septentrionalis*
- *Habrosyne scripta*
- *Halisidota caryae*
- *H. maculata*
- *H. tessellaris*
- *Haploolophus mollissima*
- *Harrisimemna trisignata*
- *Helicoverpa zea*
- *Heptagrotis phyllophora*
- *Heterocampa biundata*
- *H. guttivitta*
- *H. umbrata pulverea*
- *Holomelina ferruginosa immaculata*
- *H. laeta treatii*
- *Hormisa orciferalis*
- *Hyalophora cecropia*
- *H. columbia*
- *Hydria undulata*
- *Hydriomena divisaria*
- *Hypagyrtis subatomaria*
- *Hyperaeschra georgica*
- *Hyperetis amicaria*
- *H. nepiasaria*
- *Hyphantria cunea*
- *Hypoprepia fucosa*
- *H. miniata*
- *Hyppa xylinoides*
- *Ichthyura albosigma*
- *I. strigosa*
- *Isia isabella*
- *Itame pustularia*
- *Lacinipolia anguina*
- *L. lorea*
- *L. renigera*
- *Lambdina fiscellaria fiscellaria*
- *Lapara bombycoides*
- *Leucania commoides*
- *L. Inermis*

Table G-2 (cont.)

Order Lepidoptera (cont.)

Leucania insueta
L. luteopallens
Leuconycta diphteroides
Lithomoia solidaginis germana
Lithophane tepida
Lophodonta angulosa
L. ferruginea
Lozogramma subaegnaria
Lygris explanata
Malacosoma americanum
M. disstria
Melanolophia signataria
Metanema determinata
M. inatomaria
Metarranthis hypochraria
M. refractaria
Morrisonia evicta
Nadata gibbosa
Nedra ramosula
Nematocampa filamentaria
Nemoria rubrifrontaria
Nephelodes emmedonia
Nepytia canosaria
Notodonta basitriens
Nyctobia limitaria
Ochropleura plecta
Oligia bridghami
O. diversicolor
O. illocata
Oligocentria lignicolor
Oreta rosea
Orgyia leucostigma
Orthodes crenulata
O. cynica
O. furfurata
Orthosia revicta
Pachysphinx modesta
Pangrapta decoralis
Panthea acronyctoides
P. pallescens
Paonias exaecata
P. myops
Papaipema inquaesita
P. pterisii
Parallelia bistriaris
Parorgyia plagiata
P. vagans
Peridea angulosa
Pero honestarius
P. morrisonarius
Phaepura quernaria
Pheosia rimosa
Phlogophora periculosa f. v-brunneam
P. iris
Plagodis alcoalaria
P. kuetzingi
P. phlogosaria iris
P. serimaria
Platarctia parthenos

Table G-2 (cont.)

Order Lepidoptera (cont.)

- *Plusia aereoides*
- *Polia adjuncta*
- *P. assimilis*
- *P. detracta*
- *P. frustrata*
- *P. grandis*
- *P. imbrifera*
- *P. latex*
- *P. legitima*
- *P. lilacina*
- *P. lutra*
- *P. nimbosa*
- *P. purpurissatia*
- *Priocycla armataria*
- *Prochoerodes transversata*
- *Protaleucania albilinea*
- *Protoboarmia porcelaria indicataria*
- *Protorthrodes oviduca*
- *Pseudaletia unipuncta*
- *Pseudeva purpurigera*
- *Pseudothyatira cymatophoroides*
  - *f. expultrix*
- *Pyrausta fumalis*
- *Pyrrhia exprimens*
- *Raphia frater*
- *Rusina bicolorago*
- *Rhyacionia buoliana*
- *Rhynchagrotis cupida*
  - *f. brunneipennis*
- *Schizura concinna*
- *S. ipomoeae*
- *Schizura unicornis*
- *Scoliopteryx libatrix*
- *Semiothisa bisignata*
- *S. dispuncta*
- *S. oweni*
- *S. ulsterata*
- *Sicya macularia*
- *Sideridis maryx*
- *Smerinthus cerisyi*
- *S. geminatus*
- *Sparganothis violaceana*
- *Sphinx chersis*
- *S. drupiferarum*
- *S. gordius*
- *S. kalmiae*
- *Sthenopis argenteomaculatus*
- *Stenaspilates zalissaria*
- *Stilpnotia salicis*
- *Symmerista leucitys*
- *Synchlora arrata*
- *Synedoidea grandirena*
- *Syngrapha alias*
- *S. epigaea*
- *S. octoscripta*
- *S. rectangula*
- *S. selecta*
- *Tacparia detersata*
- *T. zalissaria*
- *Tetracis cachexiata*
- *T. crocallata*

Table G-2 (cont.)

- Order Lepidoptera (cont.)
  - *Thera juniperata*
  - *Tolype laricis*
  - *T. velleda*
  - *Tortricida flexuosa*
  - *Xanthotype urticaria*
  - *Xylotype acadia*
  - *Zale aeruginosa*
  - *Z. horrida*
  - *Z. minerea*
  - *Zanclognatha jacchusalis*

- Order Diptera (True Flies)
  - Family Chaoboridae
    - *Chaoborus* sp.
  - Family Heleidae
    - *Bezzia* sp.
  - Family Chironomidae (Midges)
    - *Metriocnemus* sp.
    - *Chironomus* sp.
    - *Pelopia* sp.
    - *Tendipes* sp.
  - Family Simuliidae
    - *Parasimulium* sp.
    - *Prosimulium* sp.
    - *Simulium* sp.

Species Status:

Until a full inventory of Park invertebrate species is conducted it is not possible to determine the status of species known to occur in the Park. With the exception of light trap data, currently available information only records the presence of a species in certain specific areas of the Park and gives no indication of relative abundance.

Species of Significance:

Invertebrate species are considered to be of significance if they cause serious damage to vegetation inside or outside the Park boundaries, if they are a major food species for game fish, if they are threatened or rare, or if they are a pest to Park visitors.

1. Terrestrial Species:

Spruce Budworm

The larval form of the Spruce Budworm Moth (*Choristoneura fumiferana*) is a defoliator of Balsam Fir (*Abies balsamea*) and White, Red and Black Spruce (*Picea glauca*, *P. rubens*, and *P. mariana*, respectively) in Nova Scotia, New Brunswick, Quebec, and the northeastern part of the United States. The Spruce Budworm appears to have a natural population cycle of major irruptions every 35 years (Morris, 1958) in large, pure stands of its host species. Severe defoliation repeated over several years can result in stunting of growth or death of the host tree (Talerica, 1983).

The Spruce Budworm is present in Kejimkujik National Park. Figure G-1 (a) gives total individuals caught per year in the Park's light trap. Numbers trapped vary considerably from year to year but these variations may be the result of behavioural influences. The budworm moth travels in clouds of individuals and these clouds are influenced by wind direction and speed. In addition the moths do not fly in bad weather. Both of these habits could influence annual trap counts for Spruce Budworm (L.P. Magasi, pers. comm.).

Kettela (1975) considered budworm numbers in Kejimkujik National Park to be "very low" and since the population had not increased since then it can also be said that current populations are very low. In addition, since there are no large, pure stands of either fir or spruce in the Park it is extremely unlikely that budworm populations could reach densities high enough to cause a population irruption inside or outside the Park's boundaries.

Gypsy Moth

The Gypsy Moth (*Lymantria dispar*) is currently spreading into southern Nova Scotia from New Brunswick and the northeastern United States. In New England it is a serious defoliator (in its larval form) of Large-toothed Aspen (*Populus grandidentata*), Red Oak (*Quercus rubra*), Hop-Hornbeam (Ironwood; *Ostrya virginiana*) and members of the genus *Amelanchier* (the Serviceberries).

Adult male Gypsy Moths have been found in varying numbers in Kejimkujik National Park since pheremone traps were placed in the Park in 1971. There are two possible sources for these moths in the Park. First, since the males are strong fliers they may have flown or been blown into the area. Or, second, they may have been transported into the Park as larvae, pupae or egg masses on recreational vehicles coming from infected areas. To date (1985) no females have been found in the Park and there have been no reports of egg masses found in the area. Since the female Gypsy Moth cannot fly, the only way that the moth could become established in Kejimkujik National Park is if female larvae, pupae or egg masses were brought to the Park from infected areas outside the Park.

Eastern Hemlock Looper

The Eastern Hemlock Looper (*Lambdina fiscellaria fiscellaria*), in its larval form, is a defoliator of hemlock (*Tsuga* spp.) and Balsam Fir. Its attacks weaken and stunt the host, often allowing secondary pests to attack and kill the tree. Figure G-1 (b) gives total individuals caught per year in the Park's light trap.

Tent Caterpillars

Two species of tent caterpillar (the Forest Tent Caterpillar; *Malacosoma disstria* and the Eastern Tent Caterpillar; *M. americanum*) occur in Nova Scotia and in Kejimkujik National Park. The first species is a defoliator of Trembling Aspen (*Populus tremuloides*), oaks (*Quercus* spp.)

and apple (_Malus_ spp.). Figure G-2 (c) and G-2 (d) give total individuals caught per year in the Park's light trap for the Forest and Eastern Tent Caterpillars respectively.

Lesser Maple Spanworm

The Lesser Maple Spanworm (_Itame pustularia_) is widespread throughout eastern Canada and occurs in varying numbers in Kejimkujik National Park. The larva of this moth is a voracious feeder on the leaves of maples, particularly the Red Maple (_Acer rubrum_). Figure G-3 (e) gives total individuals caught per year in the Park's light trap. This species appears to be increasing in numbers in the Park.

Biting Insects

The presence, in season, of a number of species of biting flies (Class: Insecta; Order: Diptera) including mosquitoes (Family: Culicidae), black flies (Family: Simuliidae), and midges (Family: Ceratopogonidae) "...is acknowledged as an aspect of the natural environment..." (of Kejimkujik National Park) (Parks Canada, 1979). The many ephemeral pools in the forests of the Park provide a breeding ground for the mosquitoes while fast-flowing streams and rivers are the breeding ground for black flies and midges. These species' population levels vary from year to year, and throughout a season, according to the amount of favourable breeding habitat available. In times of high numbers these species may be an irritation to some Park visitors.

Fig. G-1 (a) Spruce Budworm

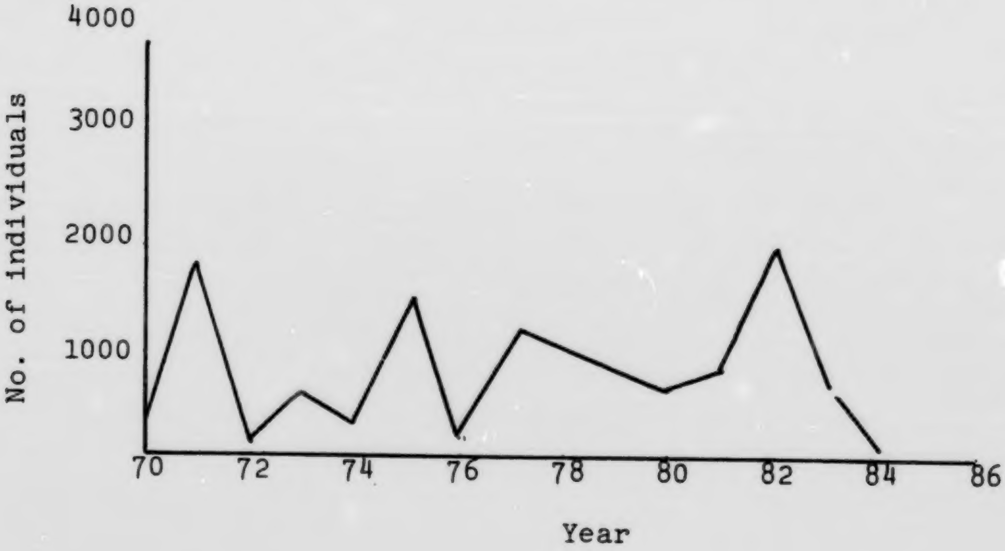


Fig. G-1 (b) Eastern Hemlock Looper

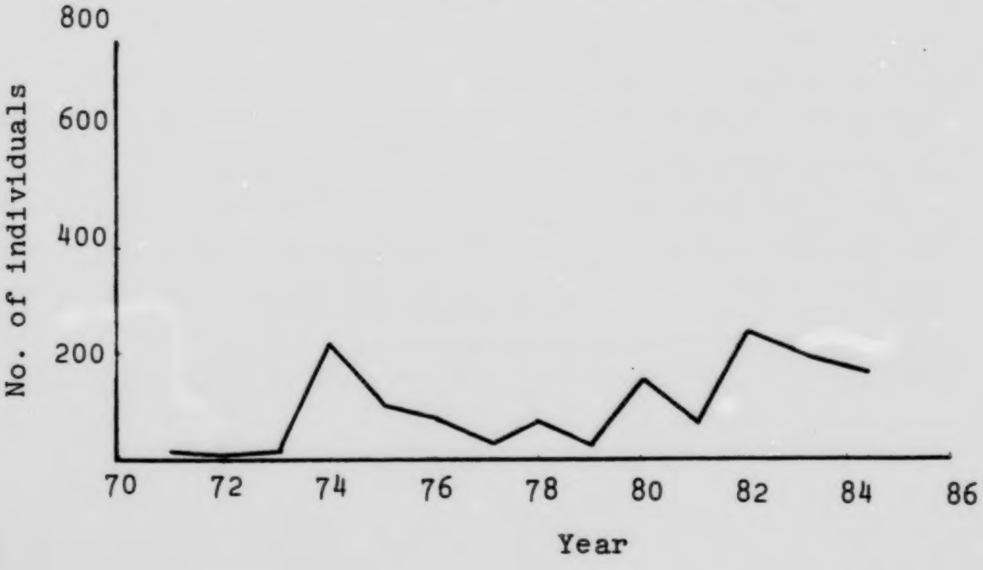


Fig. G-2 (c) Forest Tent Caterpillar

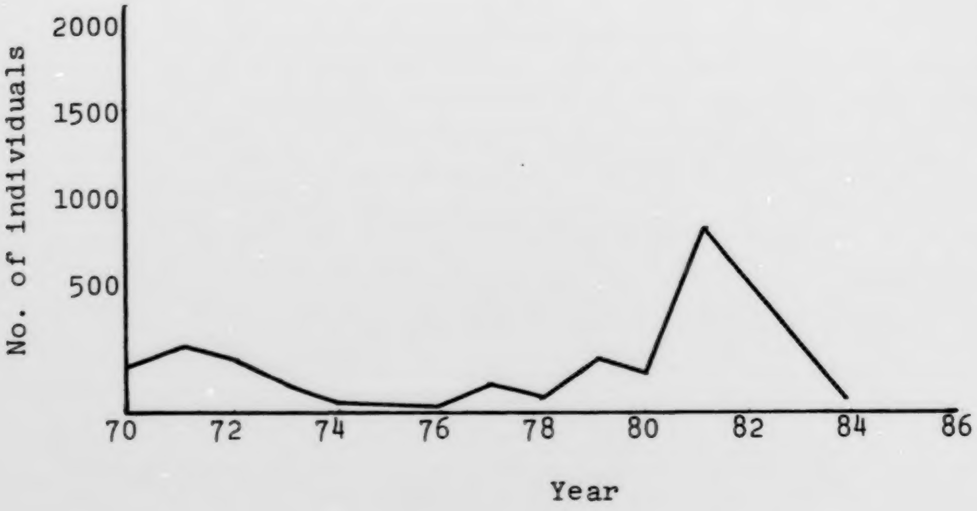
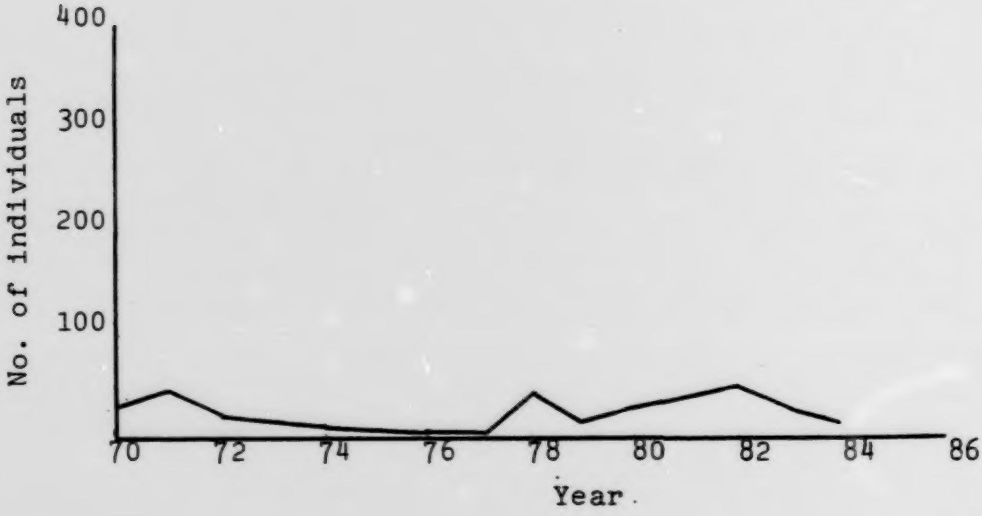


Fig. G-2 (d) Eastern Tent Caterpillar



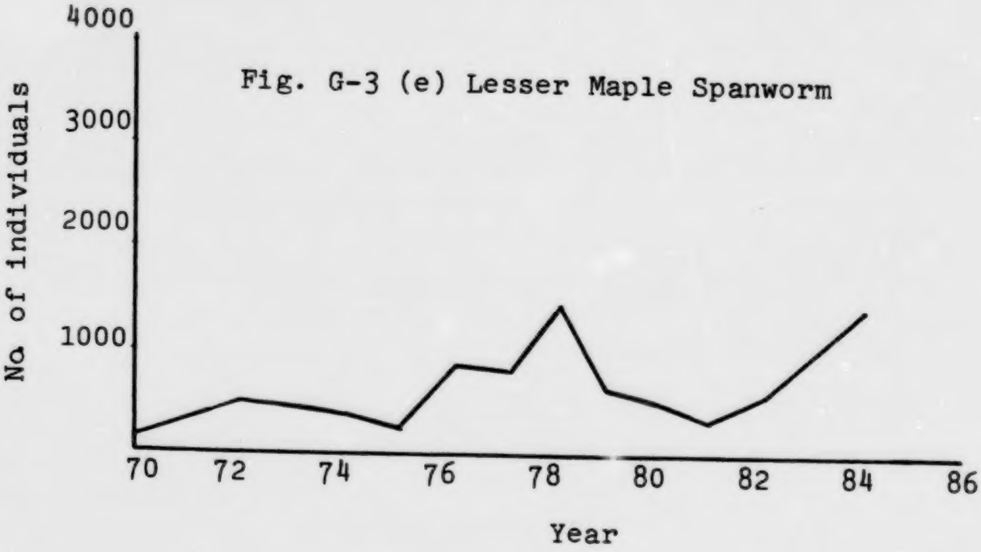


Fig. G-3 (e) Lesser Maple Spanworm

American Dog Tick

The American Dog Tick (Class: Arachnida; Order: Acarina, *Dermacentor variabilis*) is well established in the Park and southern Nova Scotia. The adult form is found during the spring and early summer in areas "covered with grass or underbrush" (Dodds *et al*, 1969; p. 175). It is less frequent in forested areas. The female is a parasite of warm-blooded animals, needing a blood meal in order to produce eggs. The tick is a concern to some Park visitors because of its potential as a vector of diseases such as Rocky Mountain Spotted Fever and Q-Fever. Domestic pets are often parasitized by the dog tick and this also is a concern to some Park visitors.

Philomycus carolinianus flexuolaris

This species is a land Gastropod which inhabits old forests and is vulnerable to changes in its habitat due to clear-cutting or other development (Isnor, 1981). This species has been found in northern Queens County and may occur in the Park.

2. Aquatic Species

In a study of fish and their feeding habits in Kejimkujik National Park, Peterson *et al* (1983) determined the stomach contents of four species of fish from various lakes in the Park. Food preference varied according to fish species and also fish size. The preferred foods included adult and larval forms of many insect orders including Ephemeroptera, Diptera (especially Chironomids), Coleoptera, Trichoptera and Odonata. Plankters such as

Copepods and a number of Cladocerans were also found. Park Resource Conservation staff report finding the stomachs of Speckled Trout (Salvelinus fontinalis) "packed full" of the nymphs of the insect order Odonata (the dragonflies and damselflies).

Asselus communis

This species is a fresh-water Isopod and has been listed as vulnerable to changes in pH (Isnor, 1981). It has been identified in Pebbleloggitch, Beaverskin and Kejimkujik Lakes (Knox, 1981).

Ochre Lamp Mussel

The Ochre Lamp Mussel (Lampsilis ochracae) has a sporadic and restricted distribution in slow-moving rivers and streams that have sandy or muddy bottoms (Isnor, 1981). It has been found in the southern part of the province of Nova Scotia and may occur, in suitable habitat, in Kejimkujik National Park. More study is required to determine the status of the species.

Resource Management Concerns:

1. Acid precipitation, through its effects on the soils and waters of the Park, could adversely affect populations of invertebrate food species important for game fish and other wildlife.

2. The Gypsy Moth, if it becomes successfully established in the Park, could pose a major threat to the hardwood trees of the Park's forests.

3. Large gaps exist in the knowledge of the Park's invertebrate fauna. This could make possible future management decisions more difficult to make.

Research Requirements:

1. Some work has been done to catalogue and determine abundance and distribution of aquatic invertebrates in several lakes in the Park. Similar work is required in other lakes to present a more complete picture of the aquatic invertebrate fauna of the Park. Work should also be done to quantify invertebrate densities in streams and rivers since these habitats are important to some species of game fish and other wildlife.

2. With the exception of the forest pest monitoring programme no work has been done on terrestrial invertebrates in the Park. A study of soil invertebrates is suggested as a method to assess the impact of acid precipitation on the ecosystem and the effects of soil compaction in heavy visitor use areas.

3. A complete inventory of the Park's invertebrate fauna should be compiled from provincial and federal museum collections where specimens were obtained from the Park area either before or after the Park was established.

Recommendations for Management:

Since relatively little is known about the Park's invertebrate fauna it would be premature to make specific recommendations for management at this time. However, the position of invertebrates at or near the bottom of many food chains makes them important in terms of other faunal types including fish and wildlife. Monitoring of forest pests shows that current populations are relatively low and, as a result of the predominantly mixed forests in the Park, relatively stable.

With the above in mind, two general recommendations are in order:

1. Invertebrate species that are food for game fish should be further investigated to determine species of major significance and their status, distribution and habitat requirements in the Park.

2. Forest pest species should continue to be monitored with particular attention paid to Spruce Budworm and Gypsy Moth. The former species is not a concern in the Park at this time but it is a controversial species outside the Park. The latter species, a non-native to North America, has the potential to inflict major damage on the forests of the Park should it become established. It may become necessary to conduct a Gypsy Moth eradication programme in the Park where feasible.

Opportunities:

As has been outlined above, there are many areas for future research into the invertebrate fauna of the Park. Some aspects of this research could be conducted by students of Ecology at the various universities in Nova Scotia. This would give the students valuable field experience and Parks Canada would obtain "free" base data on the invertebrate fauna of the Park.

Certain aspects of the life cycles of various invertebrate species (the emergence of adult Odonates in mid-summer, for example) lend themselves to interpretation by Park staff to the public. Similarly, the importance of native invertebrate species as a basic food source for wildlife and as part of a balanced ecosystem can also be interpreted.

Limitations:

Many invertebrate species may be adversely affected by acid precipitation, while others face conflicts with man for dwindling forest products. The current paucity of information on the Park's invertebrate fauna could limit responses by the Park to external pressures for control. Biting insects and ticks may cause potential Park visitors to avoid Kejimkujik National Park during certain times of the year. However, a programme of public education concerning insect pests and repellants can reduce this problem and eliminate public misconceptions about these species.

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FISH

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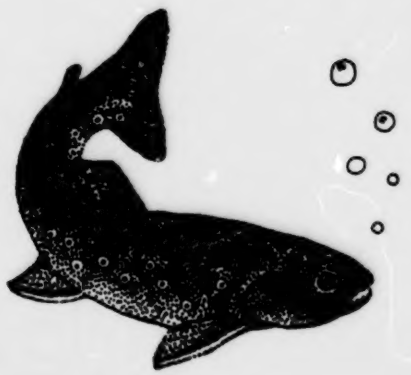


Description:

Fifteen species of fish occur, or have occurred, in the waters of Kejimkujik National Park (Table H-1).

Table H-1 Fish Species of Kejimkujik National Park

Alewife (Gaspereau)	*Alosa pseudo harengus*
Rainbow Trout	*Salmo gairdneri*
Atlantic Salmon	*Salmo salar*
Brown Trout	*Salmo trutta*
Brook Trout	*Salvelinus fontinalis*
Lake Whitefish	*Coregonus clupeaformis*
Golden Shiner	*Notemigonus crysoleucas*
Creek Chub	*Semotilus atromaculatus*
White Sucker	*Catostomus commersoni*
Brown Bullhead	*Ictalurus nebulosus*
American Eel	*Anguilla rostrata*
Banded Killifish	*Fundulus diaphanus*
Ninespine Stickleback	*Pungitius pungitius*
White Perch	*Marone americana*
Yellow Perch	*Perca flavescens*

Six of these species, including Brook Trout, Brown Trout, Rainbow Trout, Atlantic Salmon, Lake Whitefish, White Perch and Yellow Perch, are considered to be gamefish and, as such, are managed and their capture is regulated under the National Parks Act. The current composition and distribution of the Park's fish populations is the result of a number of factors.

Table H-2 Cultural Influences on the Kejimkujik Fishery

Year	Event	Effect
pre-1900	Micmacs utilize trout, gaspereau, salmon and eels for food.	Fish populations normal with natural species composition.
early 1900's	Whitefish hatchery established in Kempt.	Whitefish introduced to Park waters; reproducing populations still exist in some lakes.
1904	Kedgemakooge Rod and Gun Club established.	Systematic exploitation of gamefish begins.
1929	Construction of power dams on Lower Mersey.	Salmon and gaspereau prevented from upstream migration; eel young still able to migrate. Natural trophic interrelationships altered.
1935	Grafton Lake Fish Hatchery and dam built.	Trout stocking begins. Brown Trout and Atlantic Salmon escapes are anomalies to the natural population. Dam restricts normal fish movements.
1960	Attempt to establish Rainbow Trout in North Cranberry Lake.	Failed.
1968	Brown Trout stocking ended.	1,061,242 Brown Trout stocked since 1937.
1969	Brook Trout stocking ended.	1,705,130 Brook Trout stocked since 1937.
1974	Fish Hatchery closed.	
1974	K.N.P. officially proclaimed.	Federal regulations become applicable.
1950's to present	Acidity of lakes and rivers increasing.	Possible lower productivity and higher mortality of young; shift from acid intolerant species (trout) to acid tolerant species (perch).

The Pleistocene glaciation, which ended approximately 14,000 years ago, eradicated fish species of the time. The Isthmus of Chignecto restricted re-invasion of the Province to a relative few freshwater species following the recession of the ice (Kerekes, 1975). Subsequent events in the cultural history of the province (Table H-2) have also influenced the occurrence of fish species in the Park area.

Evaluation:

Management Objectives:

Objective

To manage fish species and aquatic ecosystems in Kejimkujik National Park to ensure the maintenance of endemic fish species populations.

Sub-objectives

1. To permit a regulated game fishery, while ensuring that such activities have a minimal impact on Park fish populations.

2. To monitor fishing pressure, harvest and elements of fish biology to determine the status of fish populations in Kejimkujik National Park.

3. To monitor the effects of fishing, watershed use and pollution, occurring outside Park boundaries, but which could influence Park fish resources.

4. To ensure no exotic species are introduced to the aquatic systems of Kejimkujik National Park.

5. To undertake the re-introduction of extirpated species where feasible, thus restoring natural ecological relationships.

6. To re-establish and maintain, where feasible, natural fish passage on water bodies that have been obstructed by human activity.

7. To monitor elements of the hydrological cycle in Kejimkujik National Park to determine the nature and impact of various man-caused and natural changes, and to correct problems where feasible.

8. To monitor and mitigate impacts of anglers on streams, lakeshores, trails, and launch areas, and to educate anglers about the conservation ethic, and the non-consumptive values of fish in National Parks.

Species Status:

Table H-3 shows the status of fish species that have occurred or currently occur in the Park. Five species are listed as having unknown status since relatively little is known about their population dynamics inside the Park.

Table H-3 Status of Fish Species, Kejimkujik National Park

Species	Game Species	Origin	Status in KNP	Status in Atlantic Region
Alewife (Gaspereau)		Indigenous	Extirpated	Common
Rainbow Trout	yes	Introduced	Failed	Unknown
Atlantic Salmon	yes	Indigenous	Extirpated	Restricted
Brown Trout	yes	Introduced	Unknown	Unknown
Brook Trout	yes	Indigenous	Common	Widely distributed
Lake Whitefish		Introduced	Restricted	Limited to points of introduction
Golden Shiner		Indigenous	Common	Common
Creek Chub		Indigenous	Unknown	Common
White Sucker		Indigenous	Common	Common
Brown Bullhead		Indigenous	Common	Common
American Eel		Indigenous	Common	Abundant
Banded Killifish		Indigenous	Common	Widely distributed
Ninespine Stickleback		Indigenous	Unknown	Unknown
White Perch	yes	Indigenous	Common	Common
Yellow Perch	yes	Indigenous	Common	Abundant

Neither distribution nor abundance of fish species is uniform in the Park (Kerekes, 1974) (Table H-4). Both are influenced by limnological conditions of the Park's waters. Lakes are shallow and become quite warm during the summer months thus limiting cool water species (Brook Trout and Lake Whitefish) to the deeper holes. The Brown Trout has slightly higher temperature tolerances than Brook Trout (Scott and Crossman, 1973). The remaining species are warm water tolerant. These species are limited by the fact that all waters in the Park are oligotrophic (Kerekes, 1974).

Kerekes (1982) has related pH to number of fish species per lake (Figure H-1). Scatter of points about the curve is partially explained by the influence of such factors as lake size and diversity of habitat. Yellow Perch and American Eel were the most pH tolerant species, occurring in lakes with pH 4.1, while Brook Trout and White Perch were not found in lakes with pH 4.7 or lower. White Sucker, Brown Bullhead, Golden Shiner and Banded Killifish were found only in lakes with pH 4.6 and higher.

Table H-4 Distribution of Fish in Thirty Lakes in Kejimkujik National Park

(Note: Lakes not sampled: Dennis Boot, Liberty, Little Cook, Little Liberty, Mount Tom, Poplar, Second McGinty)

LAKE	American Eel	Lake Whitefish	Brown Trout	Brook Trout	Golden Shiner	Creek Chub	White Sucker	Brown Bullhead	Banded Killifish	Ninespine Stickleback	White Perch	Yellow Perch
Back	+			+	+		+	+	+		+	+
Beaverskin	+			+	+		+	+	+		+	+
Ben												
Big Dam (South)	+		?	+	+		+	+			+	+
Big Dam (North)	+		?	+	+	+	+	+	+		+	+
Big Red												+
Channel	+			+	+		+	+	+		+	+
Cobrielle	+	+		+	+		+	+			+	+
Frozen Ocean	+			+			+	+			+	+
George	+			+	+		+	+			+	+

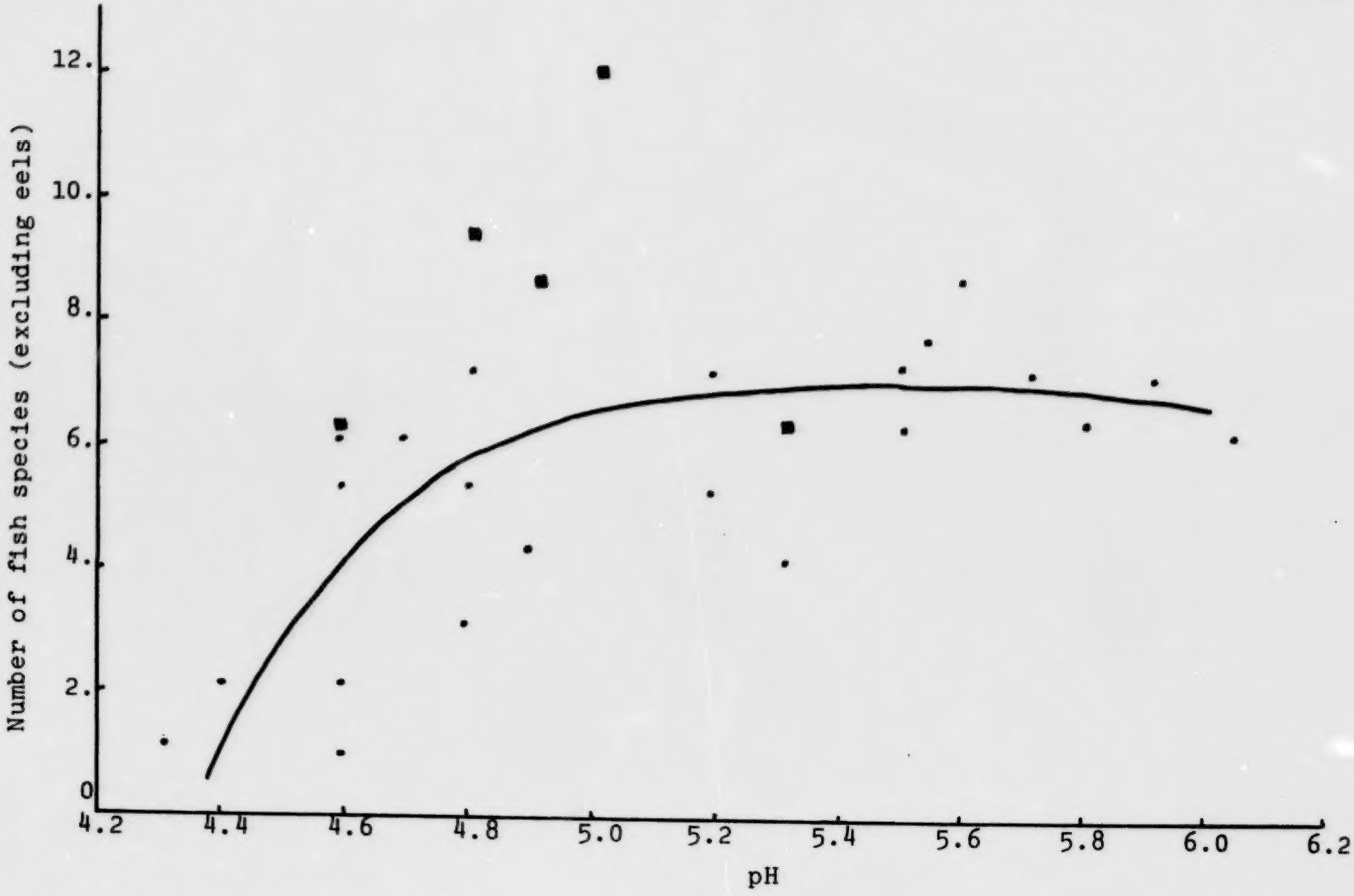
Table H-4 (cont.) Distribution of Fish in Thirty Lakes in Kejimkujik National Park

LAKE	American Eel	Lake Whitefish	Brown Trout	Brook Trout	Golden Shiner	Creek Chub	White Sucker	Brown Bullhead	Banded Killifish	Ninespine Stickleback	White Perch	Yellow Perch
Grafton	+		?	+	+	+	+	+	+		+	+
High	+			+	+		+	+	+			+
Hilchemakaar	+			+	+		+	+	+		+	+
Kejimkujik	+	+	+	+	+	+	+	+	+	+	+	+
Little Kempton				+				+				+
Little Peskowesk	+			+	+		+	+	+		+	+
Little Red												+
Loon	+			+	+		+	+	+		+	+
Lower Silver	+			+	+		+	+	+		+	+
Luxton				+								+
McGinty	+			+	+		+		+		+	+
Mountain	+	+		+			+				+	+

Table H-4 (cont.) Distribution of Fish in Thirty Lakes in Kejimkujik National Park

LAKE	American Eel	Lake Whitefish	Brown Trout	Brook Trout	Golden Shiner	Creek Chub	White Sucker	Brown Bullhead	Banded Killifish	Ninespine Stickleback	White Perch	Yellow Perch
Mud	+			+			+	+				+
North Cranberry	+			+	+			+				+
Pebbleloggitch	+							+				+
Peskawa				+	+		+	+	+			+
Peskowesk	+	+		+	+		+	+	+	+		+
Puzzle				+	+			+			+	+
Snake	+				+		+	+	+		+	+
Upper Silver	+			+	+		+	+			+	+

Fig. H-1 Number of Fish Species and pH in 29 Lakes in Kejimkujik National Park



high IBP Index of Basin Permanence
(large lake)

(After Kerekes, 1982)

Species of Significance:

Brook Trout

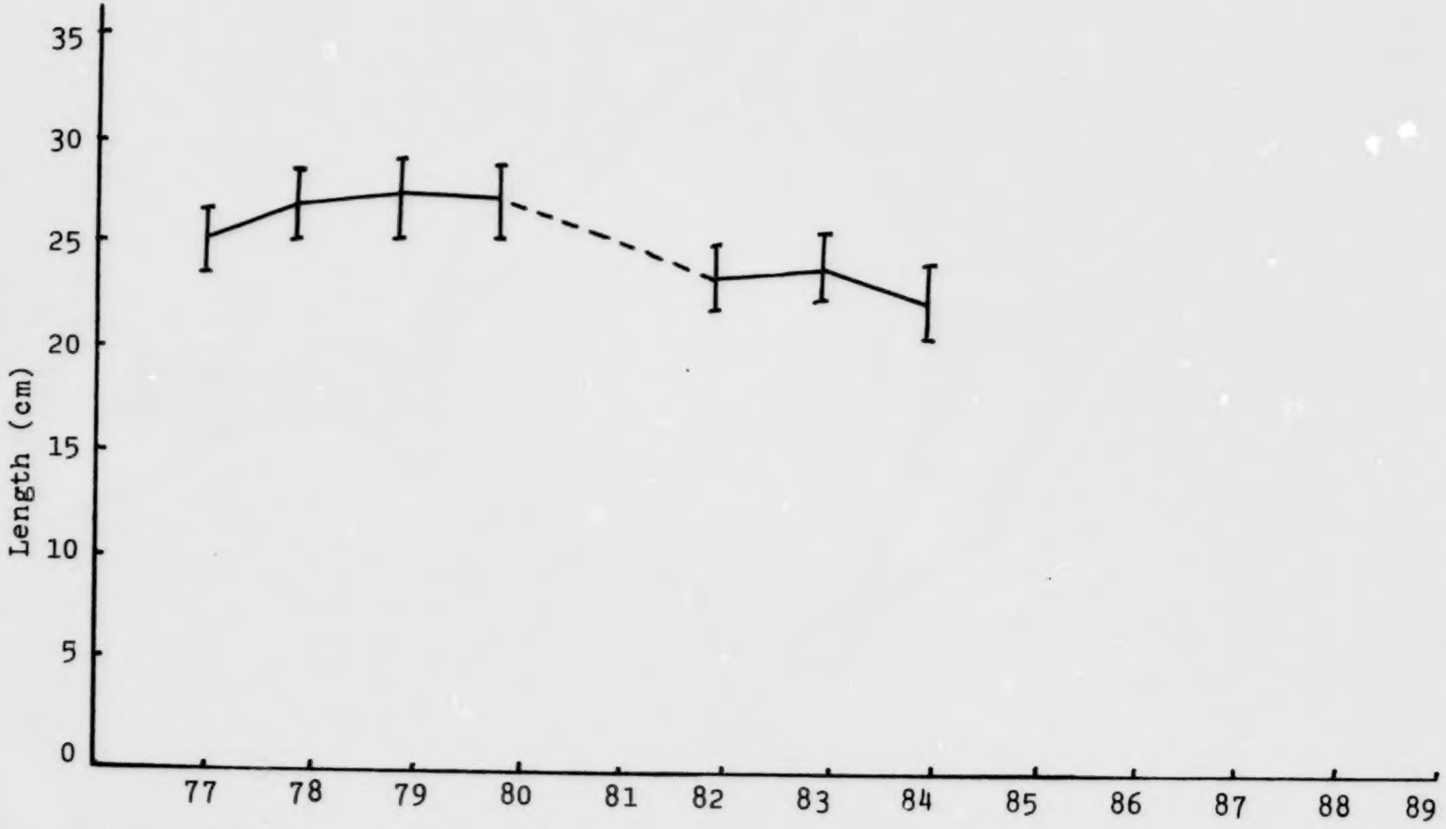
The primary game species in Kejimkujik is the Brook Trout, and as such it is the most significant in terms of management. Any management decisions must be made in light of the dual objective of maintaining a viable population, while at the same time allowing regulated harvesting on a sustained yield basis.

Creel census data have shown an apparent decline in mean length of trout caught in the Lower Mersey during the period 1977 to 1985 (Fig. H-2). Creel census data have also shown that the majority of fish angled were in the 2+ and 3+ age class. Results of a trout tagging study corroborated these observations (McCormack, 1985). Research from other sources suggests that Kejimkujik trout populations may be suffering egg and fry mortality from low pH in a majority of Park lakes and rivers (Drysdale, C. *et al*, 1986). After two years of study, there appears to be a seasonal migration of trout through the Eel Weir, involving movements over relatively large distances (Fig. H-3 and Fig. H-4). This movement probably results from feeding behaviour, and the search for suitable water temperature and pH values as seasonal water conditions change.

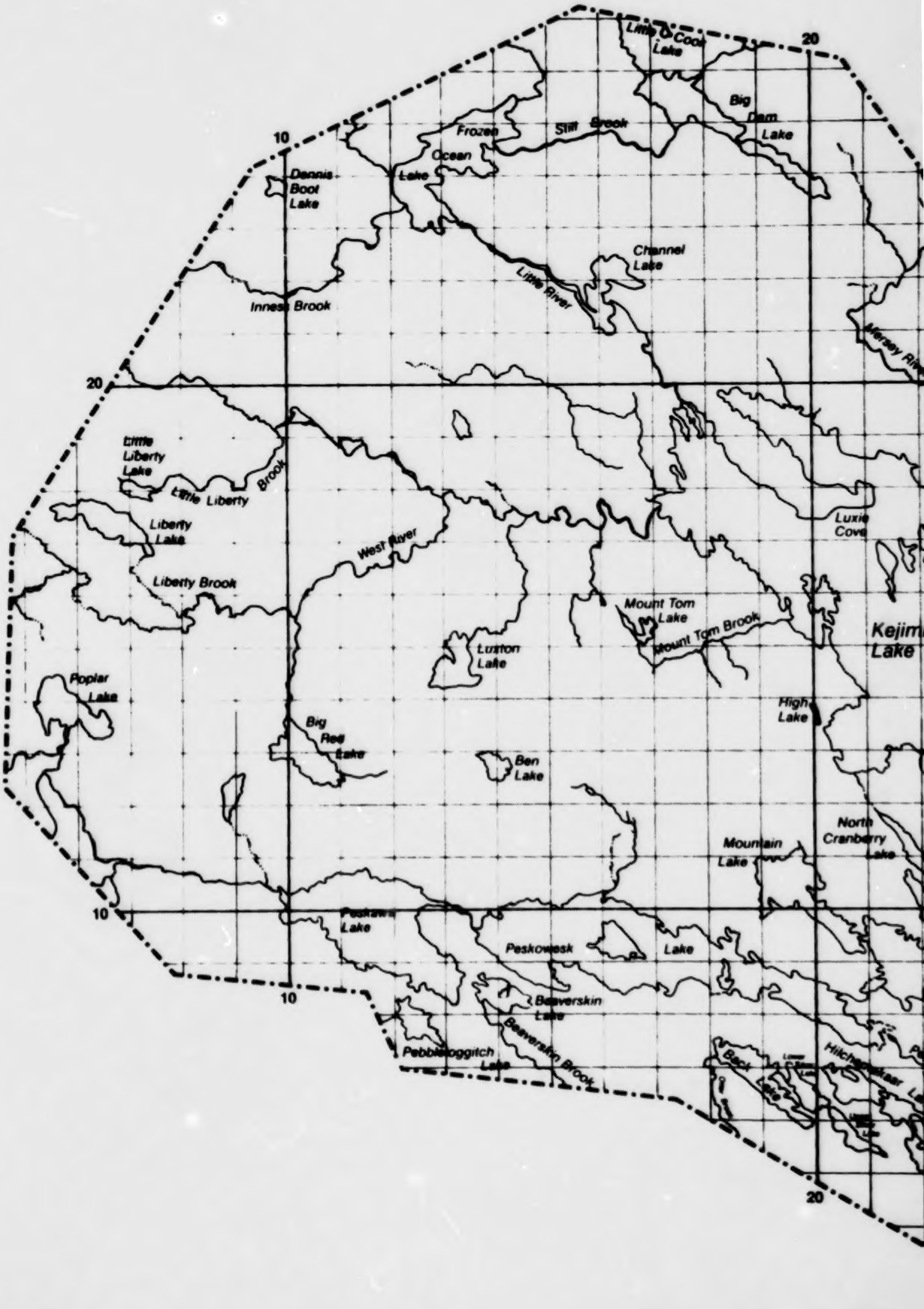
Brown Trout

Brown Trout is an aggressive introduced European species that may compete with natural populations of Brook Trout. Its current status in the Park is unknown. Four Brown

Figure H-2 Mean Length (95% C.I.) of Brook Trout Caught Annually in the Mersey River below Kejimkujik Lake



(from Drysdale et al, 1986, in prep.)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West River
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Luxie Cove
Mount Tom Lake
Mount Tom Brook
Kejim Lake
Luxton Lake
Poplar Lake
High Lake
Big Red Lake
Ben Lake
North Cranberry Lake
Mountain Lake
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Peskawa Lake
Peskowesk Lake
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Beaverskin Lake
Beaverskin Brook
Pebbleloggitch Lake
Back Lake
Hitchemakaar
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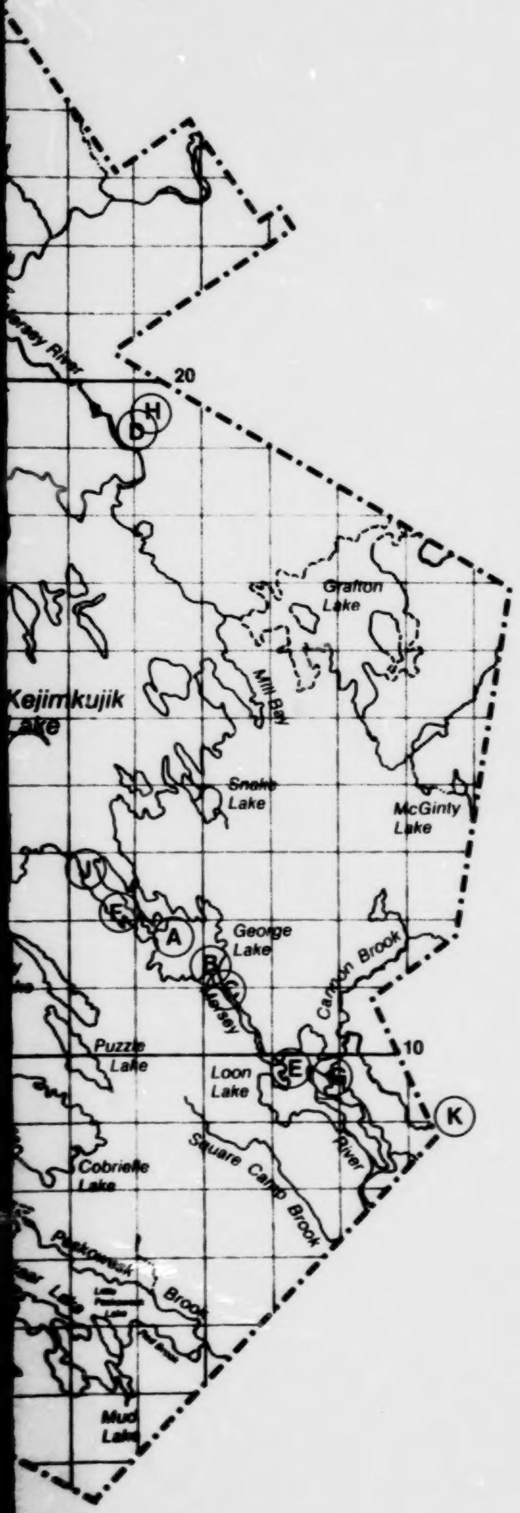
Mersey River
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D
H
Grafton Lake
Mill Bay
Kejimkujik Lake
Snake Lake
McGinty Lake
J
F
A
George Lake
B
C
Mersey
Cannon Brook
10
Puzzle Lake
Loon Lake
E
G
K
River
Cobrielle Lake
Square Camp Brook
Peskowesk Brook
Mud Lake

Figure H-3

Location of Captured Tagged Trout, 1984

(Bacon, 1984)

13.05.84 Ⓐ ⟶	26.05.84 Ⓑ	#696
27.05.84 Ⓒ ⟶	14.06.84 Ⓓ	#113
17.04.84 Ⓔ ⟶	21.05.84 Ⓕ	#194
21.05.84 Ⓖ ⟶	21.09.84 Ⓗ	#706
02.06.84 Ⓙ ⟶	22.09.84 Ⓚ	#848

Kejimkujik
National Park
Parks Canada
Atlantic Region
Miles 1 0 1 2 3
Metres 1000 0 1000 2000 3000 4000
Yards 1000 0 1000 2000 3000 4000
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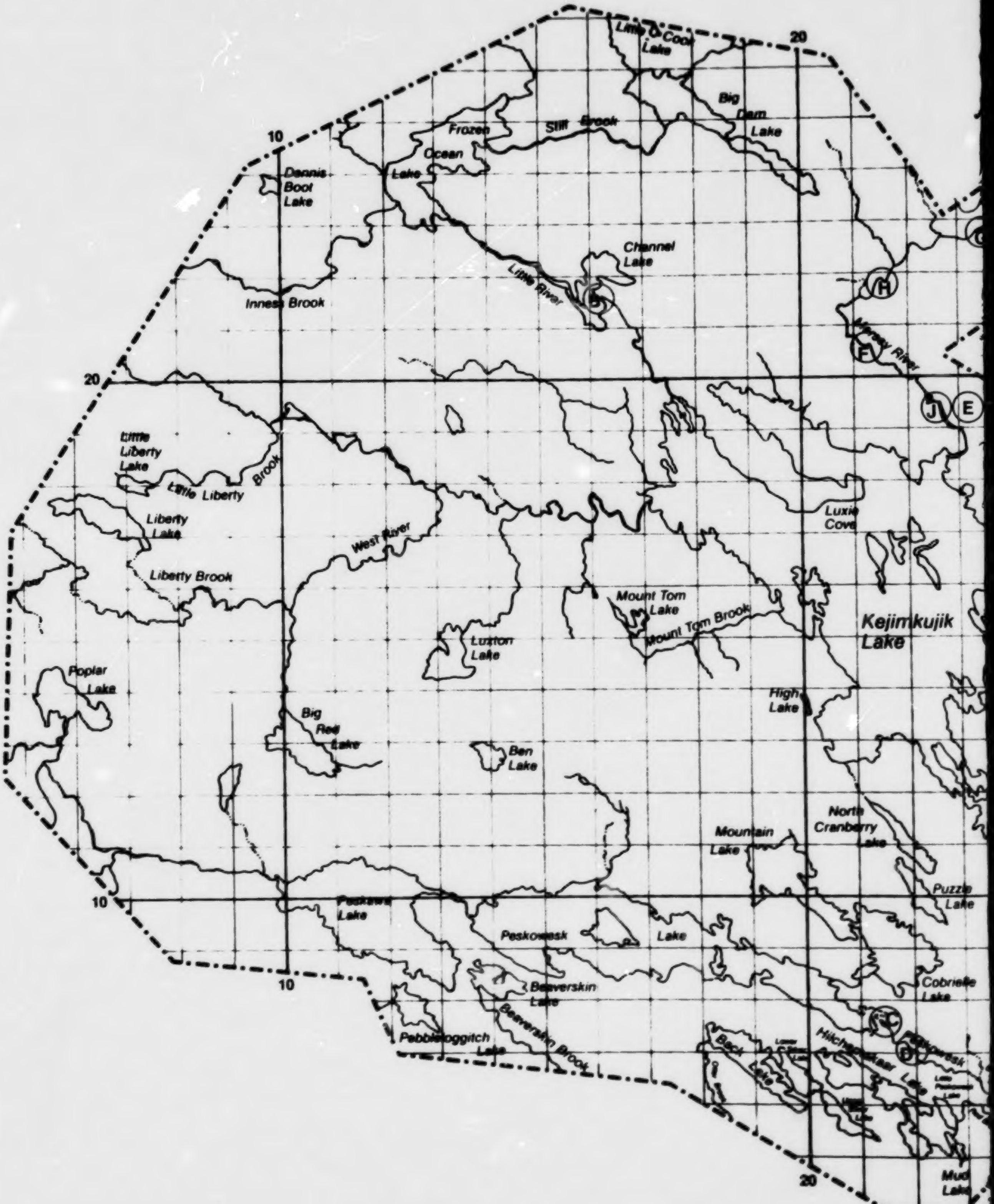
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Little Liberty Lake
Little Liberty Brook
Liberty Lake
West River
Liberty Brook
Luxie Cove
Mount Tom Lake
Mount Tom Brook
Kejimkujik Lake
Luxton Lake
Poplar Lake
High Lake
Big Red Lake
Ben Lake
North Cranberry Lake
Mountain Lake
Puzzle Lake
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Peskawa Lake
Peskowesk Lake
Cobrielle Lake
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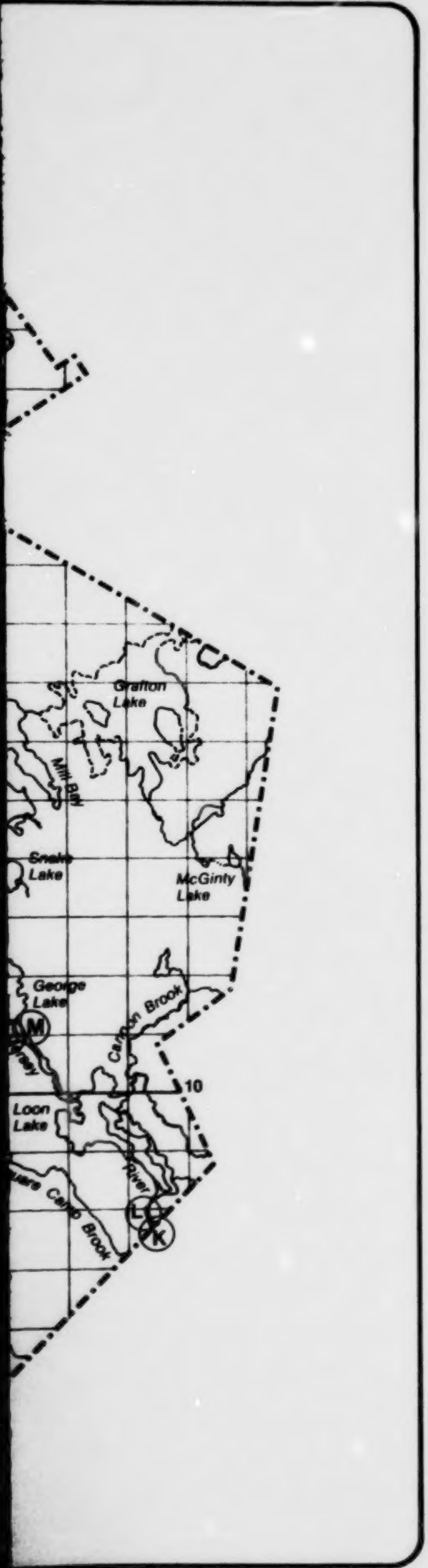
Grafton Lake
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Snake Lake
McGinty Lake
George Lake
Brook
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Loon Lake
River
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Figure H-4

Location of Captured Tagged Trout, 1985

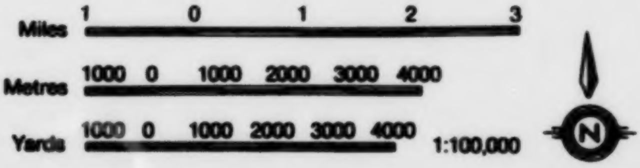
(after Bacon, 1984)

04.06.84 Ⓐ →	26.04.85 Ⓑ	#910
14.10.84 Ⓒ →	20.04.85 Ⓓ	#188
21.09.84 Ⓔ →	01.07.85 Ⓕ	#768
24.10.84 Ⓖ →	02.07.85 Ⓗ	#782
19.10.84 Ⓙ →	19.05.85 Ⓚ	#104
18.05.85 Ⓛ →	19.05.85 Ⓜ	#160

N.B. Not all recaptured fish for 1985 are shown since they apparently did not move significantly from the point of tagging.

Kejimkujik National Park

Parks Canada Atlantic Region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Trout were tagged in 1985 as part of the trout tagging programme. There is evidence of a breeding of Brown Trout population in the Kejimkujik Lake watershed.

Lake Whitefish

Lake Whitefish is an introduced North American species that is restricted by its habitat requirements to four lakes in the Park. Its food preferences--aquatic insect larvae, molluscs and amphipods (Scott and Crossman, 1973) --coupled with a need for cool water in the summer may place the Lake Whitefish in competition with native species.

Resource Management Concerns:

1. Increased acidification of the Park's waters as a result of acid precipitation may be having an effect on the structure and distribution of the Park's fish populations. It has been shown that Brook Trout are variably sensitive to increased acidification of their habitat depending on the stage in their life cycle at which they are exposed. Other species, such as Yellow Perch, are more acid tolerant and may be surviving where trout are not.

2. Creel census and tagging data suggest that the Brook Trout population size and structure is changing, possibly as a result of human influence. Sales of fishing permits from Kejimkujik National Park have increased steadily since 1977 with a decline commencing in 1984 and continuing in 1985 (Table H-5).

Continuing study is needed to determine the effects of angler pressure on the resource.

Table H-5 Fishing Permit Sales, Kejimkujik National Park and Immediate Area

Year	1977	1978	1979	1980	1981	1982
# permits sold	1231	1266	1416	1400	1479	1670

Year	1983	1984	1985	1986	1987	1988
# permits sold	1861	1698	1362			

Year	1989	1990	1991	1992	1993	1994
# permits sold						

3. As outlined in Table H-2, various events in the cultural history of the area have influenced the composition of the Park's fish populations. The two most critical are the construction of dams in the lower reaches of the Mersey and on Grafton Brook, and the historic introduction of non-native species (Brown Trout, Lake Whitefish) to the Park area. The former has affected fish distribution and movements while the latter may have led to interspecific competition with indigenous species.

Research Requirements:

There is a need for more knowledge of the population by dynamics of the Park's Brook Trout population. Creel census and tagging data have contributed some data. However, more information is needed on spawning, feeding and nursery habitats, seasonal movements and distribution, age and size relationships and the effects of angling pressure on the Park's fish population.

The effects of increased environmental acidity on the Park's fish populations requires further study. There are indications that the Park's Brook Trout population may be more acid tolerant than populations elsewhere in North America (Drysdale, 1980). It has been suggested by Blouin and Lane (1982) that at least on a short-term basis, liming, when used to restore neutral pH, may be injurious to a lake's zooplankton community when that community has had sufficient time to adapt to decreased pH.

The effects of competition from introduced species such as Brown Trout and Lake Whitefish on indigenous Brook Trout populations should be investigated.

Grafton Lake has been rendered inaccessible to migratory fish species by the dam on Grafton Brook. Since the lake has the best water quality of all lakes in the Park, and since there is considerable potential spawning and feeding habitat in the lake and its watershed, the feasibility of constructing a fishway around the dam should be studied.

Considerable information is available on the physical and chemical properties of the Park's waters. However, more information is required on the aquatic biotic resources. Kerekes' (1975) study requires updating with regard to the biology and distribution of fish in the Park.

Recommendations for Management:

1. Angling and environmental acidification appears to be placing excessive pressure on the Park's Brook Trout populations. It is recommended that angling pressure on Brook Trout be reduced through appropriate means to ensure protection of remaining populations.

2. It is recommended that angling for White and Yellow Perch be promoted to distribute angling pressure more evenly among species, and to expand the scope of angling opportunities.

3. The dam on Grafton Brook is restricting access by migratory fish species to Grafton Lake. It is recommended that a fish ladder be built around the dam to permit access by fish to good spawning areas in the lake's watershed.

4. It is recommended that the tagging programme be continued. This study will provide valuable information on trout movement and population dynamics in the Park.

5. It is recommended that the creel census be continued with efforts made to increase the sample size utilizing various appropriate techniques.

6. It is recommended that a study be initiated to determine the effects of low environmental pH on the survival of fish eggs and fry.

7. The feasibility of closing a representative watershed as a benchmark preservation area should be investigated.

8. Co-operation should be encouraged between Parks Canada and the Nova Scotia Department of Fisheries to promote protection of the shared game fish resource.

9. Provided natural fish passage is re-established in the lower Mersey River, re-introduction of extirpated species should be conducted.

Opportunities

Brook Trout provide a good opportunity for angling, particularly early in the spring. White and Yellow Perch provide opportunities for angling later in the season, although they are not, currently, utilized to their full potential.

Brook Trout caught in the spring and early summer have been found to have consumed large numbers of dragonfly and damselfly nymphs (Bacon, pers. comm.). At other times of the year trout utilize other foods. The ecology of the Brook Trout and other fish species provide the opportunity to interpret the significance of food webs and habitat utilization in the natural environment.

Grafton Lake has the best water quality of all lakes in the Park. Thus, it has potential as an important location for fish to feed and spawn.

Brook Trout in the Kejimkujik area may have developed a physiological tolerance to reduced pH levels in certain instances (Drysdale, 1980). An opportunity exists to investigate this hypothesis for resource management and academic purposes.

Limitations:

Most lakes in the Park are relatively shallow and, therefore, become too warm during the summer to support large numbers of trout. Similarly, most lakes in the Park are low in nutrient availability. This, also, lowers trout productivity.

Increased acidity of Park waters as a result of acid precipitation may be affecting fish populations. Trout are sensitive to low pH and will tend to avoid these areas. Thus trout habitat in the Park may be restricted by increased acidity of the water.

The dam on Grafton Brook is a barrier to fish movements to and from Grafton Lake. This limits trout access to potentially good spawning and feeding areas.

The headwaters of many brooks in the eastern portion of the Park are outside Park boundaries, and consequently are beyond regulation by the National Parks Act. Activities in these areas could have an impact on the Park's fish resources.

The majority of sport fishing in the Park takes place early in the season (spring and early summer) at a time when trout are more concentrated in certain areas. This could lead to over-exploitation of the resource and affects its future.

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AMPHIBIANS

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Description:

Kejimkujik National Park is a natural haven for salamanders, frogs and toads. All of the thirteen known species of amphibians in Nova Scotia are found in the Park or its immediate vicinity. The abundance of slow-moving rivers, streams, shallow lakes, bogs and a few marshes, coupled with warm summers and moderate winters, are probably the main reasons why Kejimkujik features such a variety of amphibians.

Table I-1 is a species distribution list for the amphibians of Kejimkujik National Park. Comments on morphology, reproduction and behaviour are included.

Table I-1

The Amphibians of Kejimkujik National Park

SALAMANDER	HABITAT	COMMENTS
Blue-spotted Salamander	Woodlands near aquatic breeding sites (small ponds, slow vegetated streams, alder swamps), under rocks and rotten logs.	-breeds in early spring -adults are terrestrial -larvae are aquatic -restricted distribution in N. S. (See Fig. 2)
Yellow-spotted Salamander	Woodlands near aquatic breeding sites (bogs, ponds, lake coves and boggy streams), live underground.	-breeds in early spring, often in great numbers -adults are terrestrial -larvae are aquatic -hard to find after breeding
Red-spotted Newt	Larvae and adults live in ponds, slow moving streams and lake coves. Juveniles (Red efts) live in woodlands, on or under leaf litter.	-breeds in early Spring -three distinct appearances: larvae, juveniles, adults -eats insects, leeches, worms and frog eggs -few predators eat Newts -skin glands produce an unpleasant substance -Red offspring not afraid to venture into the open

Table I-1 (cont.)

SALAMANDER	HABITAT	COMMENTS
Eastern Redback Salamander	Inhabits most woodland habitats but can be found in blueberry fields.	-breeds in fall and lays eggs the following June -no aquatic stage -lay eggs in rotten logs -lungless, breathes through skin -eats insects, earthworms, beetles -hides under logs, rocks, etc. -eggs are guarded by adults
Four-toed Salamander	Deciduous or mixed woodland near sphagnum bogs or boggy streams that are used for egg laying.	-breeds in fall and lays eggs in spring -known to share nesting sites -four toes on front and back feet -rare and endangered in N. S. -vulnerable to human disturbance when nesting

TOADS & FROGS	HABITAT	COMMENTS
Eastern American Toad	Most terrestrial areas of the Park. Found in ponds, lakes and streams when breeding.	-breeds in early spring -terrestrial -eats insects, beetles, worms, ants -hibernates in burrows in soil of the forest
Northern Spring Peeper	Inhabits woodlands near aquatic breeding sites (almost any small body of water or quiet streams and lake coves).	-one of the first frogs to breed in early spring -congregates in great numbers during spring mating -has special adaptations on toes for climbing trees and bushes -hibernates under leaf litter -terrestrial -camouflaged well -smallest frog in Park

Table I-1 (cont.)

TOADS AND FROGS	HABITAT	COMMENTS
Bull Frog	Large vegetated ponds, lake coves and slow streams.	-breeds in summer -an aquatic frog -only abundant in southwest N.S. in Atlantic Canada -restricted population -largest frog in Park -eats almost anything that moves smaller than itself
Mink Frog	Vegetated shallows of lakes and slow moving streams, particularly among water lilies and pickerel weed.	-our last frog to breed in summer -mostly aquatic -produces a musky odor when frightened -easily confused with green frogs -easier to capture than green frog
Green Frog	Practically any body of fresh water, wet meadows and grassy woodlands.	-breeds in early summer -mostly aquatic -distinctive banjo-string-like call -makes a startling noise as it is frightened into water -calls freely during day or night
Wood Frog	Moist wooded areas, migrates to ponds, bogs, roadside ditches and lake coves to breed.	-one of the first frogs to breed in early spring -terrestrial -large numbers in breeding ponds -not seen often after breeding -call is a low pitched clacking or quacking like a duck from a distance -has a facial mask like the Lone Ranger -common in Canada from coast to coast

Table I-1 (cont.)

TOADS AND FROGS	HABITAT	COMMENTS
Northern Leopard Frog	Meadows, old fields, floodplains and grassy woodlands near aquatic breeding sites.	-breeds in late spring (May) -terrestrial -eats grasshoppers and other insects -a good jumper -call sounds like a "snore" -hibernates in mud in ponds -common across Canada
Pickerel Frog	Lakeshore, bogs, meadows, streams, and grassy fields.	-breeds in late spring (May) -aquatic and terrestrial -a frog with square spots -few snakes will eat it as its skin gland secretion is distasteful -call is a low "snore"

Evaluation:

Management Objectives:

1. To maintain natural populations of Park amphibians by protecting habitat areas, and by utilizing other management procedures as required.

2. To minimize conflict between amphibians and humans, and where a problem exists, take action based on species status and other related factors.

3. To gather data on amphibians population status, distribution, and sensitivity to man-caused habitat alteration in Kejimkujik National Park.

Species Status:

A full inventory of the amphibians of Kejimkujik has not been completed to date. Species status and distribution information is therefore subject to verification. (Table I-2.)

The following is a species status list for the amphibians of Kejimkujik National Park.

Table I-2	Status in Kejimkujik Nat. Park	Status in N.S.	Status in Maritime Canada	Status in Canada
SALAMANDERS				
Blue-spotted Salamander *Ambystoma laterale*	hypothetical*	central NS to Cape Breton	all prov. except Nfld.	Man. to NS
Yellow-spotted Salamander *Ambystoma maculatum*	common throughout	common throughout	all prov. except Nfld.	Ont. to NS
Red-spotted Newt *Notophthalmus viridescens*	common throughout	common throughout	all prov. except Nfld.	Ont. to NS
Eastern Redback Salamander *Plethodon cinereus*	common throughout	common throughout	all prov. except Nfld.	Ont. to NS
Four-toed Salamander *Hemidactylium scutatus*	common locally	scattered to rare throughout	(rare in NB and NS)	Ont., NB, NS and PQ
FROGS AND TOADS				
Eastern American Toad *Bufo americanus americanus*	common throughout	common throughout	all prov. except Nfld.	Man. to NS
Northern Spring Peeper *Hyla crucifer crucifer*	common throughout	common throughout	all prov. except Nfld.	Man. to NS

Table I-2 (cont.)	Status in Kejimkujik Nat. Park	Status in N.S.	Status in Maritime Canada	Status in Canada
FROGS AND TOADS (cont.)				
Bull Frog *Rana catesbeiana*	common in suitable habitat	mainland only, only abundant in SW N.S.	southern NS mainland NS	SW BC, Ont., PQ, NB, NS
Green Frog *Rana clamitans melanota*	common in suitable habitat	common throughout	all prov.	Man. to Nfld.
Mink Frog *Rana septentrionalis*	common in suitable habitat	scattered throughout	NB & NS	Man., Ont., PQ, Lab., NB, NS
Wood Frog *Rana sylvatica*	common throughout	common throughout	all prov.	all prov.
Northern Leopard Frog *Rana pipiens*	common in suitable habitat	common throughout	all prov.	all prov.
Pickerel Frog *Rana palustris*	common in suitable habitat	common throughout	NB & NS	Ont. to NS

*two sightings near Park (Bleakney 1952 and Brownlie 1983)

Species of Major Significance:

1. The Four-toed Salamander is rare and endangered in Nova Scotia (Fig. I-1), rare in New Brunswick and absent in Prince Edward Island.

2. The Blue-spotted Salamander is rare in southwestern Nova Scotia and has a restricted distribution in the province. (Fig. I-2.) This salamander has not been found in the Park to date, but it would be expected, as it has been seen in Maitland Bridge, Annapolis County and three km east of the main Park entrance, along Highway 8.

Resource Management Concerns:

1. At present, the pH of many of the Park's lakes, streams and ephemeral ponds is approaching marginal status for amphibians. It has been suggested that amphibians would be among the first to suffer if acid levels rise as a result of acidification processes (e.g. acid rain). Grafton Lake, one of the only buffered lakes in the Park, would be very important as a refuge for amphibians.

2. Nest disturbance by humans has been demonstrated to cause desertion in the case of the Four-toed Salamander (Breitenback, 1982). Park monitoring programmes should avoid disturbance of amphibian nesting habitats during nesting season. Similarly selected habitat areas should be protected from general human disturbance.

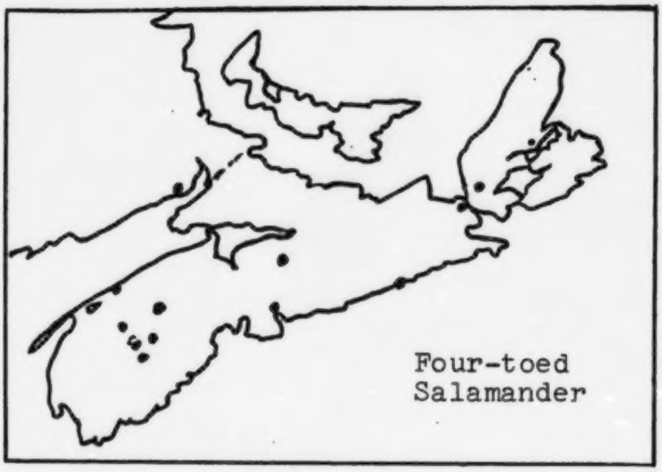

Four-toed
Salamander

Fig. I-1

Isnor, W. 1981

Known sightings of
Four-toed Salamanders
in Maritime Canada.

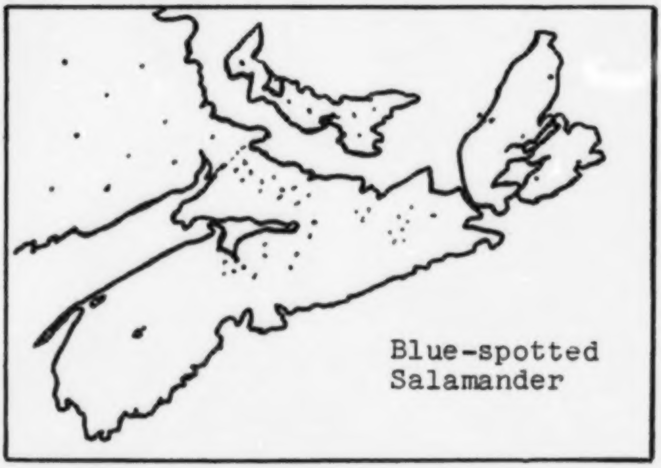

Blue-spotted
Salamander

Fig. I-2

N.S. Museum 1984

General Distribution
of the Blue-Spotted
Salamanders in N. S.

Research Requirements:

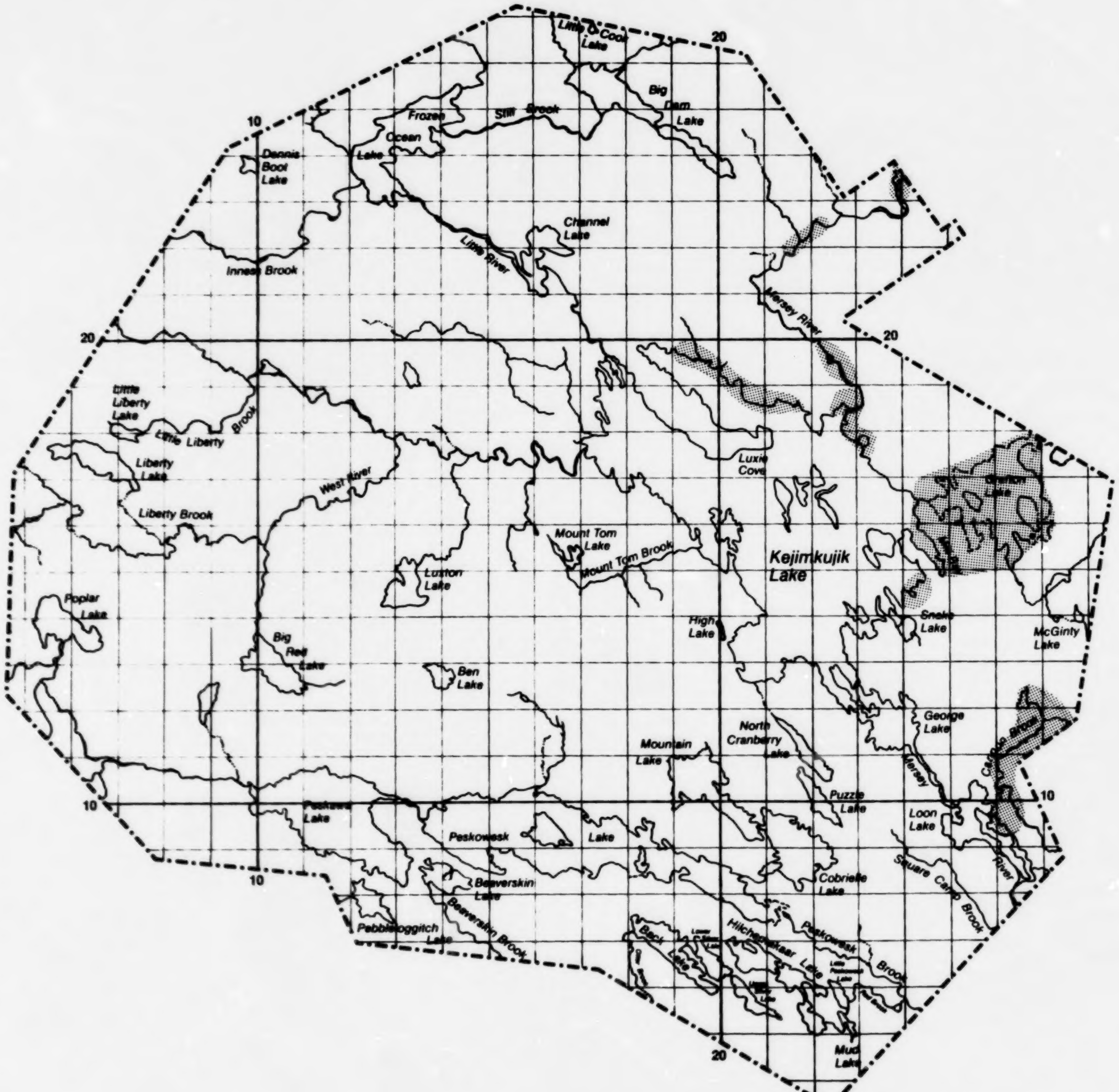
1. The Blue-spotted Salamander was first seen by S. Bleakney near Maitland Bridge in the early 1950's, one kilometer from the Park. J. Brownlie reported it in 1983, three kilometers east of the Park's main entrance on Highway 8. To date this salamander has not been seen in the Park. It is therefore recommended that surveys be carried out to verify the status of this salamander in Kejimkujik National Park.

2. To date the amphibian species inventory for Kejimkujik National Park is relatively incomplete. It has been suggested that the amphibians would be among the first fauna to be affected by decreasing environmental pH, as caused by acid rain. In this context it is necessary to carry out research including a more complete inventory of Kejimkujik amphibia for future reference and comparison.

Recommendations for Management:

1. The status of Grafton Lake as an important habitat for amphibians should be maintained. The preparation of a management plan for the Grafton Lake zone area should include provisions for water level regulation to ensure preservation of existing amphibian habitat (Fig. I-3).

2. Public access should be restricted on selected sphagnum moss bogs bordered by deciduous or mixed woodlands to insure protection for nesting Four-toed Salamanders.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Little Liberty Lake
Little Liberty
Brook
Liberty Lake
Liberty Brook
West River
Luxie Cove
Mount Tom Lake
Mount Tom Brook
Kejimkujik Lake
Luxton Lake
Poplar Lake
High Lake
Snake Lake
McGinty Lake
Big Red Lake
Ben Lake
George Lake
North Cranberry Lake
Mountain Lake
Mersey
Puzzle Lake
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Loon Lake
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Peskawa Lake
Peskowesk
Lake
Beaverskin Lake
Cobrielle Lake
Square Camp Brook
River
10
Pebbleloggitch Lake
Beaverskin Brook
Back Lake
Hilchemakaar Lake
Peskowesk Brook
Mud Lake
20

Figure I-3

▨ Important Amphibian Habitat

(inventory is incomplete)

Kejimkujik National Park

Parks Canada   Atlantic Region

Miles 1 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

Yards 1000 0 1000 2000 3000 4000   1:100,000

N

3. Education programs to illuminate the existence and significance of amphibians in Kejimkujik National Park should be continued.

Opportunities:

The amphibians provide a number of opportunities for interpretation and research, as mentioned in the appropriate sections above. The diversity of amphibia in Kejimkujik help illustrate the moderate climate conditions in the area. Similarly, the susceptibility of the amphibia to reductions in environmental pH provide opportunities for the researcher, and the interpreter, to demonstrate the impact of acid rain. The vocalization of the frog species in springtime can be used as an aid in inventory, and as a focus for guided walks and slide talks.

Limitations:

The major threat to the amphibia in Kejimkujik National Park is likely to be habitat destruction from environmental acidification. This is of particular concern when spring snow melt releases concentrations of acidified run-off. Ephemeral ponds, often used by Park amphibians, can be rapidly rendered lethal to eggs and larvae. Excessive breeding habitat disturbance by humans, or drastic changes in habitat water levels, can also damage or eliminate amphibian populations.

Databank File Code:

Sighting records and population profiles for the Amphibia of Kejimkujik National Park can be accessed from the Resource Conservation Computer File located at the Park Administration Office. The codeword "Amphib" must be utilized to obtain or contribute observations to file.

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REPTILES

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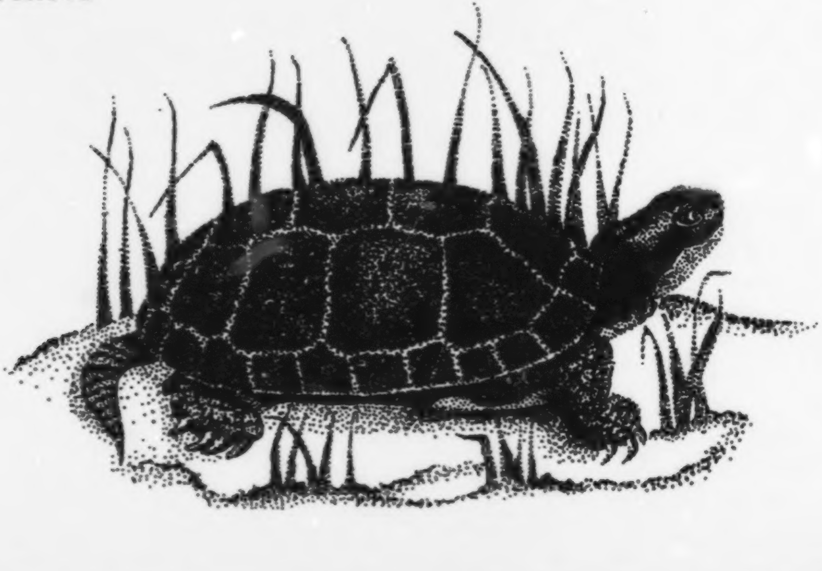


Description:

Kejimkujik is by far the most important National Park for reptiles in Atlantic Canada. Eight reptile species are found in the Park; five snake species and three turtle species. Southwestern Nova Scotia ranks second only to southern Ontario for species diversity in the eastern Canadian region.

The following table, J-1, lists, provides habitat description and comments on the reptiles found in Kejimkujik National Park.

Table J-1

The Reptiles of Kejimkujik National Park

REPTILE	HABITAT	COMMENTS	SIGNIFICANCE
Turtles			
Eastern Painted Turtle	Ponds, lakes and slow moving streams, where water is shallow and has aquatic vegetation.	-basking turtle -require suitable nesting site	Characteristic of southern and central N.S. Restricted distribution in Canada. KNP is the only NP in which this turtle is found (see Fig. J-2).
Blanding's Turtle	Slow boggy streams near lakes and boggy lake coves. Restricted habitat (see Fig. 4).	-basking turtle -essentially aquatic but wanders about on land close to water	Disjunct population (see Fig. J-1). KNP has the only known natural nesting site in Maritime Canada. Rare and endangered in N.S.
Common Snapping Turtle	Large ponds, streams and lakes.	-short-tempered -rarely found basking -requires suitable nesting site	Characteristic of southern and central N.S. Only Maritime NP where this turtle nests.
Snakes			
Northern Redbelly Snake	Under rocks and logs in both moist and dry sites, grassy roadsides, grassy heath places, margin of old heath bogs, etc.	-smallest reptile in Park -nocturnal -live young -feeds chiefly on small slugs	Characteristic of Eastern Canada, including Acadian Forest Region.

Table J-1 (cont.) The Reptiles of Kejimkujik National Park

REPTILE	HABITAT*	COMMENTS	SIGNIFICANCE
Snakes (cont.)			
Northern Ribbon Snake	Vegetated shallows of ponds, lakes and streams. Restricted habitat.	-live young -somewhat aquatic	Disjunct population (see Fig. J-3).Only a few seen in Park. Rare and endangered in N.S.
Maritime Garter Snake	Rocky woodlands, fields, swamps, bogs and roadsides.	-live young -first to appear in spring -hibernates in large numbers	Characteristic of Acadian Forest Region, especially coastal region.
Eastern Smooth Green Snake	Grassy places along the shores of lakes, streams and ponds. Also old fields and roadsides.	-lays eggs under or in rotten logs and forest litter -feeds chiefly on moth larvae and spiders	Characteristic of Eastern Canada including Acadian Forest Region.

*J. Gilhen, 1981

Evaluation:

Management Objectives:

1. To maintain natural populations of Park reptiles by protecting essential habitat, and ensuring the application of appropriate conservation strategies.

2. To analyze the population, status and ecology of the Blanding's Turtle and Ribbon Snake and to facilitate the implementation of measures which will ensure the perpetuation of these rare reptiles in Kejimkujik National Park.

3. To minimize conflict between reptiles and humans and to foster positive attitudes towards reptiles through public education.

4. To gather information on reptile biology in Kejimkujik, including habitat requirements, reproduction, population dynamics, and mortality factors to permit effective management and protection.

Species Status:

The following Table (J-2) lists the reptiles of Kejimkujik National Park and outlines their regional status and distribution.

Table J-2 Status of Reptiles

TURTLES	Status in Kejimkujik Nat. Park	Status in NS	Status in Maritime Canada	Status in Canada	Present in Other Mar. Nat. Parks
Common Snapping Turtle (Chelydra serpentina serpentina)	common throughout suitable habitat; Rep. of Eco-region	common in SW and central NS	NS & NB only	Sask to NS	unconfirmed Kouch. NP
Blanding's Turtle (Emydoidea blandingii)	Rare See Fig. J-1	rare, endang. restricted to Park area	NS only	Ont. & NS	No
Eastern Painted Turtle (Chrysemys picta picta)	common throughout suitable habitat; Rep. of Eco-region	common SW mainland locally; common NE mainland	NS & NB only	PQ, NB, NS	No
SNAKES					
Northern Redbelly Snake (Storeria occipitomaculata)	probably common throughout	common throughout	all prov. except NFLD	Sask to NS	Yes

Table J-2 (cont.) Status of Reptiles

SNAKES (cont.)	Status in Kejimkujik Nat. Park	Status in NS	Status in Maritime Canada	Status in Canada	Present in Other Mar. Nat. Parks
Northern Ribbon Snake (*Thamnophis sauritus septentrionalis*)	Rare See Fig. J-3	Rare, endangered; Lunen. & Queens Cos.	SW N.S.	Ont. & NS	No
Maritime Garter Snake (*Thamnophis sirtalis pallidula*)	probably common throughout; Rep. of Eco-region	common throughout	all prov. except NFLD	Maritime prov. except NFLD	Yes
Northern Ringneck Snake (*Diadophis punctatus edwardsi*)	probably common throughout suitable habitat	common in SW NS; restricted in N. Cape Breton	NB & NS only	Ont. to NS	Yes
Eastern Smooth Green Snake (*Osheodrys vernalis vernalis*)	common throughout suitable habitat; Rep. of Eco-region	common throughout	all prov. except NFLD	Ont. to NS	Yes

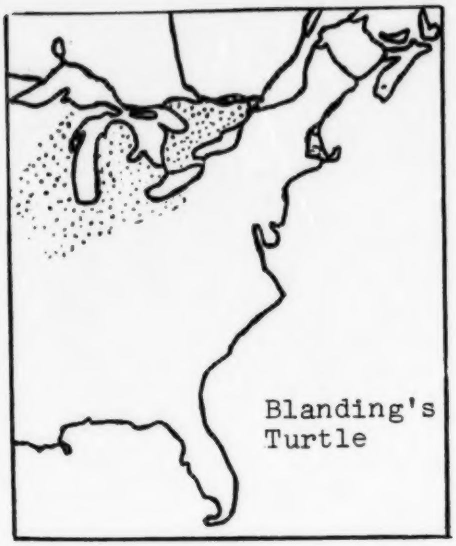
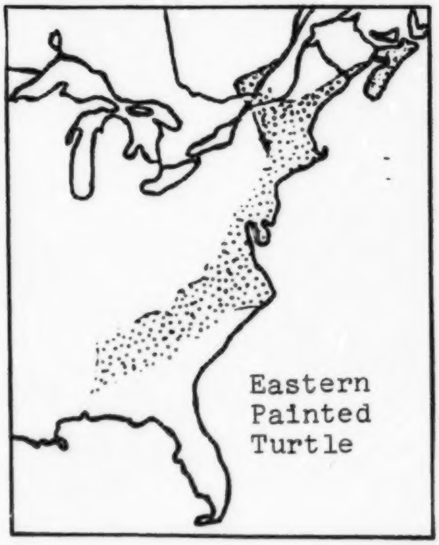

Blanding's
Turtle

Fig. J-1: General Distribution of Blanding's Turtle (*Emydoidea blandingii*) from Conant (1975).

Fig. J-2: General Distribution of Eastern Painted Turtle (*Chrysemys picta picta*) from Conant (1975).


Eastern
Painted
Turtle

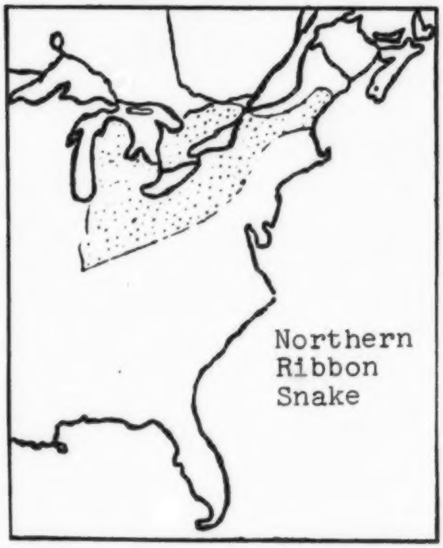

Northern
Ribbon
Snake

Fig. J-3: General Distribution of Northern Ribbon Snake (*Thamnophis sauritus septentrionalis*) from Conant (1975).

Table J-3 Representation of the Amphibians and Reptiles of the Maritimes and Newfoundland in the Seven National Parks

Species	CBH NP	Fundy NP	Gros Morne NP	Kej. NP	Kouch. NP	PEI NP	Terra Nova NP	No Rep.	Comments
American Toad	X	X		X	X	X			Not seen in Gros Morne; seen and heard in Rocky Harbour.
Atlantic Leatherback								X	Has come ashore in Gros Morne & Kouch N.P. in Maritimes
Blanding's Turtle				X					One Park only. Rare in Maritimes.
Blue-spotted Salamander		X		X	X	X			
Bull Frog		X		X					
Dusky Salamander		X							One Park only.
Eastern Garter Snake	X	X		X	X	X			

Table J-3 (cont.) Representation of the Amphibians and Reptiles of the Maritimes and Newfoundland in the Seven Atlantic National Parks

Species	CBH NP	Fundy NP	Gros Morne NP	Kej. NP	Kouch. NP	PEI NP	Terra Nova NP	No Rep.	Comments
Eastern Painted Turtle				X					One Park only.
Eastern Smooth Green Snake	X	X		X	X				
Four-toed Salamander				X					Rare in Maritimes
Green Frog	X	X	X	X	X	X	X		
Mink Frog	X	X		X					
Northern Leopard Frog	X	X		X	X	X			
Northern Red-Bellied Snake	X	X		X	X	X			
Northern Ribbon Snake				X					One Park only. Rare in Maritimes.

Table J-3 (cont.) Representation of the Amphibians and Reptiles of the Maritimes and Newfoundland in the Seven Atlantic National Parks

Species	CBH NP	Fundy NP	Gr. Morne NP	Kej. NP	Kouch. NP	PEI NP	Ter. Nova NP	No Rep.	Comments
Northern Ringneck Snake	X	X		X					
Northern Two-Lined Salamander		X							One Park only.
Pickerel Frog		X		X					
Red-backed Salamander	X	X		X		X			
Red-spotted Newt		X		X		X			
Snapping Turtle		X		X	X				
Spotted Salamander	X	X		X	X	X			
Spring Peeper	X	X		X	X	X			
Tremblay's Salamander								X	Should be looked for in Parks with Blue-spotted Salamanders.
Wood Frog	X	X		X	X	X			

Table J-3 (cont.) Representation of the Amphibians and Reptiles of the Maritimes and Newfoundland in the Seven Atlantic National Parks

Species	CBH NP	Fundy NP	Gros Morne NP	Kej. NP	Kouch. NP	PEI NP	Terra Nova NP	No Rep.	Comments
Western Chorus Frog								X	Introduced and breeding in Steady Brook area of Western Newfoundland.
Atlantic Loggerhead								X	Rare in Maritimes.
Atlantic Ridley								X	Rare in Maritimes.
Wood Turtle								X	One specimen found 9 km from Kejimkujik N.P.

Species of Significance:

1. The Eastern Painted Turtle (Chrysemys picta picta) is not found in any other National Park in Canada.

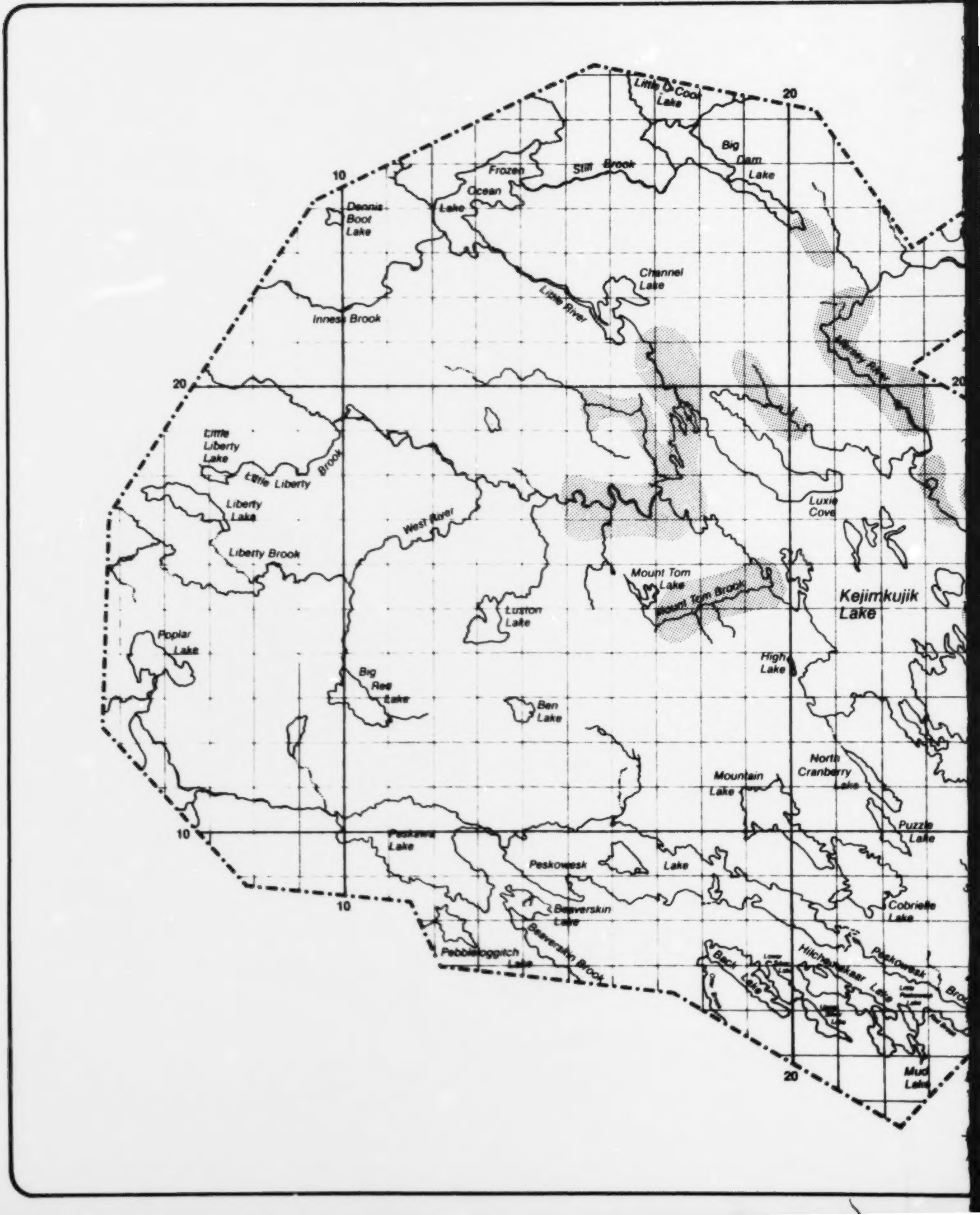
2. The Blanding's Turtle and Northern Ribbon Snake could be classified as rare and endangered in Nova Scotia. They are not found elsewhere in the Atlantic Region.

3. Kejimkujik is the only National Park in Maritime Canada to have a documented nesting population of the Common Snapping Turtle.

Resource Management Concerns:

1. The Blanding's Turtle population in the Kejimkujik area appears to be declining. Recent nesting records are becoming rare, and turtles nesting along roadsides are extremely vulnerable. Critical nesting habitat has been disturbed by heavy human usage (Fig. J-4). A population of garbage-fed raccoons may also be destroying turtle eggs in the vicinity of Jeremys Bay Campground. Specific management concerns and procedures are outlined in the approved management plan for the species entitled, "A Resource Analysis and Management Plan for the Blanding's Turtle in Kejimkujik National Park (Drysdale, 1983)".

2. The Northern Ribbon Snake has only been found occasionally in Kejimkujik. Monitoring is required to determine its status, and the need for a management plan.



Little Cook Lake
20
Big Dam Lake
10
Frozen Ocean Lake
Still Brook
Dennis Boot Lake
Channel Lake
Little River
Iness Brook
20
Little Liberty Lake
Little Liberty Brook
Liberty Lake
Liberty Brook
West River
Luxie Cove
Mount Tom Lake
Mount Tom Brook
Kejimkujik Lake
Luxton Lake
Poplar Lake
High Lake
Big Red Lake
Ben Lake
North Cranberry Lake
Mountain Lake
Puzzle Lake
10
Peskawa Lake
Peskowesk Lake
10
Beaverskin Lake
Cobrielle Lake
Beaverskin Brook
Pebbleloggitch Lake
Back Lake
Hichemakaar Lake
Peskowesk Brook
Mud Lake
20

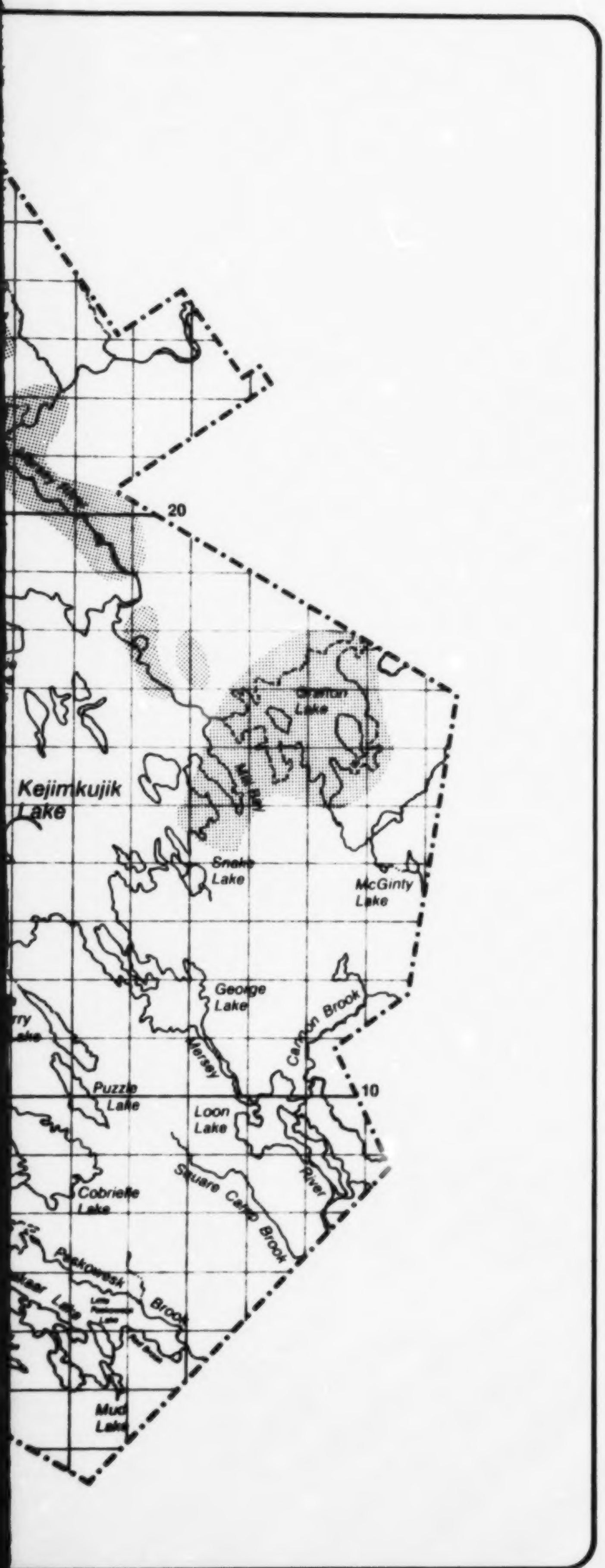

20
Grafton Lake
Kejimkujik Lake
Snake Lake
McGinty Lake
George Lake
Cannon Brook
Mersey
Puzzle Lake
10
Loon Lake
Square Camp Brook
River
Cobrielle Lake
Peskowesk Brook
Mud Lake

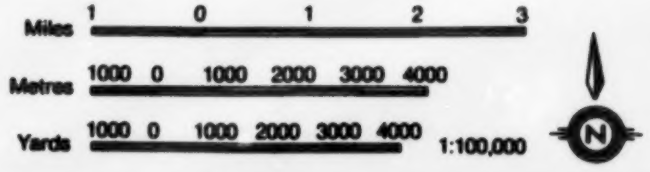
Figure J-4

Blanding's Turtle Habitat

▨ Important Blanding's Turtle Habitat

Kejimkujik National Park

Parks Canada Atlantic Region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3. Reptiles, particularly the turtles, are vulnerable to human disturbance during nesting periods. Collection, road kills, and easy predator access contribute to this vulnerability.

Study Requirements:

Turtles

Of the three turtle species in the Park, only the status of the Blanding's Turtle is threatened. The other two species are widespread and common in their respective habitats.

1. A comprehensive analysis of Blanding's Turtle status including habitat use, population dynamics, reproduction, movements, and mortality should be carried out, as per the recommendation of the approved Blanding's Turtle management plan. Management recommendations should be prepared accordingly.

2. A concerted effort should be made to determine the existence and status of juvenile Blanding's Turtles in Kejimkujik. To date, few juveniles have been found, thus raising the issue of whether Blanding's Turtles are successfully reproducing.

3. Sighting records should be kept of all Blanding's Turtles observed in the Kejimkujik area.

Snakes

Of the five snake species found in Kejimkujik National Park, only the Northern Ribbon Snake is potentially threatened. It has been sighted infrequently in a few locations. The other four species are common and widespread in their respective habitats.

1. It is recommended that a survey be carried out for Ribbon Snakes in Kejimkujik National Park using appropriate capture techniques. Habitat usage and sample size (using standard search rates and methodology) should be documented.

2. Sighting records should be kept of all Northern Ribbon Snakes observed in the Kejimkujik National Park area.

General Recommendations:

1. The natural nesting site for Blanding's Turtle, at Heber Meadow, should be fully protected, with existing trails in the area closed or re-routed.

2. A resource management plan should be prepared for the Grafton Lake area which makes provisions for appropriate water level control. The present artificial nature of water levels probably influences the existence of wetland habitat for reptiles and other wildlife.

3. The status of the Blanding's Turtle in Kejimkujik National Park should continue to be monitored according to recommendations made in the 1983 Blanding's Turtle Management Plan.

4. Studies should be undertaken to determine habitat and status of the Northern Ribbon Snake and to determine if this habitat requires additional protection.

5. Public education and interpretation programmes should continue to foster healthy attitudes toward the reptiles of Kejimkujik.

Opportunities:

The variety of reptile species in Kejimkujik National Park provides the opportunity for a comprehensive public education programme. In addition to interpreting the reptiles and their natural history, the opportunity exists to illuminate the southern nature of the Kejimkujik area. The geographic and ecological isolation of the Northern Ribbon Snake and Blanding's Turtle offer the opportunity to study evolution in progress. In time the Kejimkujik population of each species will diverge genetically from larger populations in mainland North America.

Limitations:

It has been demonstrated that disturbance of reptile species, particularly turtles in the process of nesting, can result in unsuccessful reproduction. In the case of the rare Blanding's Turtle, this is of critical concern, as the species nests in several areas of Kejimkujik close to human activity. Efforts must be made to reduce human disturbance in nesting areas. The tendency for Blanding's Turtles to nest along the main Park road shoulder could result in their extirpation in Kejimkujik.

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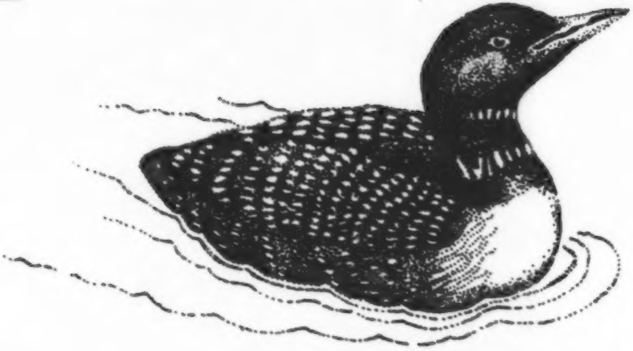
AVIFAUNA



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Description:

Kejimkujik National Park offers a diversity of habitats to the avifauna of the area. The Park lies in the transition zone between the southern hardwood forests and the northern boreal forests. It is also an area containing large numbers of rivers and lakes. Consequently the Park's avifauna contains species typical of all three habitat types. Since Nova Scotia is located in the Atlantic Migration Flyway, some transient species only occur in the Park during the migration periods. The Park is not, however, a point of concentration for migrating birds although numbers of birds and numbers of bird species tend to be higher at these times in the year.

The avifauna of the Park has been well documented. Work by Lunn (1971, 1973) was instrumental in establishing a sound base of information on the resource. Subsequent work by Park Resource Conservation and Interpretation Staff have contributed significantly to the knowledge of birds of the Park. A wildlife observation card system for use by all Park staff and visitors annually provides new information on sightings and nest records for the Park's data base. In addition, Kejimkujik National Park co-operates with external agencies by participating in the Maritime Nest Record Scheme and by conducting an annual Christmas Bird Census. A Breeding Bird Survey (route #; Kejimkujik 035) has been conducted, sporadically, since 1971 on a route from the main Park gate to the fire tower.

To date, (March, 1985) a total of 165 species of birds, representing 17 orders, have been recorded in the Park. Of this total, 67 species have been confirmed as breeding in the Park while an additional 35 species probably breed but have not been confirmed. A total of 49 species have been recorded as occurring year-round in the Park. However, some of these are found only infrequently in the winter season. Since 1971 a total of 54 species have been recorded on the Park's annual Christmas Bird Censuses. The average number of species per count, however, is approximately 30. The difference is related to the weather in a particular winter. A mild winter allows species to stay that would otherwise move south. Similarly a more severe winter may force northern species further south. Lunn (1973) has observed that, despite the large numbers of lakes and rivers in the Park, only 20% of the Park's species are associated with aquatic habitats. He attributes this to the generally low productivity of most of the Park's waters.

Table K-1 is a synthesis of information from the above sources. It lists breeding status, relative abundance by season, general habitat preference by season (where known), an indication of spring arrival and fall departure dates (for migratory species) and period of occurrence in the Park, for all species known to occur in Kejimkujik National Park.

Table K-1 Birds of Kejimkujik National Park

Breeding Status:

C - indicates a species for which there is a confirmed breeding record

Abundance:

c - common	- a species found in many habitats, often in varying numbers, usually frequently seen or heard
u - uncommon	- a species found in low numbers or only in certain habitats
r - rare	- a species usually found several times or less each year
vr - very rare	- a species found less than every year on an irregular basis
Spring	- March 16 - May 31
Summer	- June 1 - August 31
Fall	- September 1 - November 30
Winter	- December 1 - March 15

Habitat:

L - Lakes or bays

FP - Floodplain

S - Softwoods

MW - Mixed Woods

H - Hardwoods

He - Hemlock

F - Fields or clearings

B - Bog

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Common Loon Gavia immer	C	c	c	c	r	L		May,Jun,Jul,Aug	Mar,Apr,Sep,Oct,Nov,Dec
Pied-billed Grebe Podilynbus podiceps			vr	vr		L			Jun,Jul,Aug,Sep,Oct
Wilson's Storm Petrel Oceanites oceanicus				vr					Sep
Double-Crested Cormorant Phalacrocorax auritus		r	r	r		L		May,Jun,Jul,Aug	Apr,May,Sep
American Bittern Botaurus lentiginosus	C	u	u	u		FP		May,Jun,Jul,Aug	Apr,May,Sep,Oct
Great Blue Heron Ardea herodias	C	u	u	u	r	FP		May,Jun,Jul,Aug	Apr,Sep,Oct,Nov,Dec
Great Egret Casmerodius albus			one	record					
Black-crowned Night Heron Nycticorax nycticorax			one	record					
Canada Goose Branta canadensis		r		r	r	L			Mar,Apr,Aug,Sep,Oct,Nov,Dec

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Wood Duck Aix sponsa	C	r	r	r		L		May,Jun,Jul, Aug	Apr,May,Aug, Sep,Oct
Green-winged Teal Anas crecca		vr		vr		L			May,Sep,Oct, Nov
American Black Duck Anas rubripes	C	u	u	u	r	L		May,Jun,Jul, Aug,Sep	Mar,Apr,Sep, Oct,Nov,Dec
Blue-winged Teal Anas discors		vr		vr		L			Apr,May,Sep, Oct
Ring-necked Duck Aythya collaris	C	r	r	r		L		May,Jun,Jul, Aug,Sep	Apr,May,Sep, Oct,Nov
White-winged Scoter Melanitta deglandi		one record							
Common Goldeneye Bucephala clangula		u		u	u	L	L		Jan,Feb,Mar, Apr,Dec
Bufflehead Bucephala albeola		vr			vr		L		Jan,Feb.Mar
Hooded Merganser Lophodytes cucullatus	C	u	u	u	r	L	L	May,Jun,Jul, Aug,Sep	Mar,Apr,Sep, Oct,Nov,Dec
Common Merganser Mergus merganser	C	u	u	u	r	L	L	May,Jun,Jul, Aug	Mar,Apr,May, Sep,Oct,Nov

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE				HABITAT		Resident	Visitor/Transient
		Spring	Summer	Fall	Winter	Summer	Winter		
Red-breasted Merganser Mergus serrator		one record							
Osprey Pandion haliaetus		r	r	r	vr	L	L	May,Jun,Jul,Aug	Mar,Apr,May,Sep,Oct,Nov,Dec
Bald Eagle Haliaeetus leucocephalus		vr	vr	vr	vr				Jan,Feb,Mar,Apr,May,Jun,Jul,Aug,Sep,Oct,Nov,Dec
Northern Harrier Circus cyaneus		r	r	r				May,Jun,Jul,Aug	Apr,May,Aug,Sep
Sharp-shinned Hawk Accipiter striatus		u	u	u	r			May,Jun,Jul,Aug	Jan,Feb,Mar,Apr,May,Sept,Oct,Nov,Dec
Cooper's Hawk Accipiter cooperii		vr	vr	vr					Jun,Jul,Aug,Sep
Northern Goshawk Accipiter gentilis	C	u	u	u	u			Jan,Feb,Mar,Apr,May,Jun,Jul,Aug,Sep,Oct,Nov,Dec	
Broad-winged Hawk Buteo platypterus		r	r	r				May,Jun,Jul,Aug	Apr,May,Aug,Sep

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE Spring	Summer	Fall	Winter	HABITAT Summer	Winter	Resident	Visitor/ Transient
Red-tailed Hawk *Buteo jamaicensis*	C	c	c	c	c			year round	
American Kestrel *Falco sparverius*		u	u	u				Apr,May,Jun, Jul,Aug,Sep	Apr,Sep,Oct
Merlin *Falco columbarius*		vr		vr	vr				Jan,Feb,Mar, Sep,Oct,Nov, Dec
Ring-necked Pheasant *Phasianus colchicus*		vr	vr	vr	vr			year round	
Spruce Grouse *Canachites canadensis*	C	u	u	u	u	S	S	year round	
Ruffed Grouse *Bonasa umbellatus*	C	u-c	u-c	u-c	u-c	H MW	H MW	year round	
Black-bellied Plover *Pluvialis squatarola*			one record						
Semipalmated Plover *Charadrius semipalmatus*			vr	vr					Aug,Sep
Killdeer *Charadrius vociferus*			vr						Aug

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE Spring	Summer	Fall	Winter	HABITAT Summer	Winter	Resident	Visitor/ Transient
Greater Yellowlegs Tringa melanoleuca		vr	r	r					May,Aug,Sep, Oct, Nov
Lesser Yellowlegs Tringa flavipes		one record							
Solitary Sandpiper Tringa solitaria			r	r					Aug,Sep
Spotted Sandpiper Actitis macularia	C	u	u	u				May,Jun,Jul, Aug,Sep	Mar,Apr,May, Sep,Oct
Semipalmated Sandpiper Calidris pusilla			vr						Jul,Aug
Least Sandpiper Calidris minutilla			vr						Jul,Aug
Pectoral Sandpiper Calidris melanotos		one record							
Common Snipe Capella gallinago	C	u	u	u	vr	MW F		May,Jun,Jul, Aug,Sep	Apr,May,Oct, Nov
American Woodcock Philohela minor	C	u	u	u		MW F		May,Jun,Jul, Aug	Apr,Sep,Oct, Nov
Red-necked Phalarope Lobipes lobatus		one record							

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Herring Gull *Larus argentatus*		vr	vr	vr	vr	L			year-round
Great Black-backed Gull *Larus marinus*	C	u	u	u	r	L		May,Jun,Jul, Aug	Feb,Mar,Apr, Aug,Sep,Oct, Nov
Common Tern *Sterna hirundo*	C	r	u	r		L		Jun,Jul,Aug	May,Jun,Aug, Sep
Black Tern *Chlidonias niger*			one	record					
Black Guillemot *Cepphus grylle*			one	record					
Rock Dove *Columba livia*			vr	vr					Jun - Oct incl.
Mourning Dove *Zenaida macroura*		r		r					Apr,Sep,Oct
Black-billed Cuckoo *Coccyzus americanus*			vr						

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE Spring	Summer	Fall	Winter	HABITAT Summer	Winter	Resident	Visitor/ Transient
Great Horned Owl *Bubo virginianus*	C	u	u	u	u	H	FP	year-round	
Barred Owl *Strix varia*	C	c	c	c	c	H MW	H He MW	year-round	
Long-eared Owl *Asio otus*		vr	vr					May - Aug incl.	
Northern Saw-whet Owl *Aegolius acadicus*		u	u	r	r			Apr - Aug incl.	Mar,Apr,Aug, Sep,Oct
Common Nighthawk *Chordeiles minor*	C	u	c	r				Jun,Jul,Aug	May,Aug,Sep
Chimney Swift *Chaetura pelagica*	C	u	u					Jun,Jul,Aug	May
Ruby-throated Hummingbird *Archilochus colubris*	C	u	u	vr				Jun,Jul,Aug	May,Jun,Aug
Belted Kingfisher *Megaceryle alcyon*	C	u	u	u	vr			May - Sep incl.	Feb - May incl., Sep - Dec incl.

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Yellow-bellied Sapsucker *Sphyrapicus varius*	C	c	c	u		H MW FP		May - Aug incl.	Apr,May,Aug, Sep
Downy Woodpecker *Picoides pubescens*	C	c	c	c	c	H MW FP	H MW FP	year-round	
Hairy Woodpecker *Picoides villosus*	C	c	c	c	c	H MW FP	H MW S He FP	year-round	
Black-backed Woodpecker *Picoides arcticus*	C	r	r	r	r	S	S He	year-round	
Northern Flicker *Colaptus auratus*	C	c	c	c	vr			May - Sep incl.	Apr,May,Sep, Oct
Pileated Woodpecker *Dryocopus pileatus*	C	u	u	u	u		H MW He	year-round	

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE				HABITAT		Resident	Visitor/ Transient
		Spring	Summer	Fall	Winter	Summer	Winter		
Olive-sided Flycatcher Nuttallornis borealis		u	u					Jun,Jul	May - Aug incl.
Eastern Wood-Pewee Contopus virens	C	r	u	u		H		Jun,Jul,Aug	Apr,May,Jun, Aug,Sep
Yellow-bellied Flycatcher Empidonax flaviventris		r	u			S		Jun,Jul,Aug	May,Jun,Aug
Alder Flycatcher Empidonax alnorum		r	u			H He MW FP		Jun,Jul,Aug	May,Jun
Least Flycatcher Empidonax minimus	C	u	c	c				May - Aug incl.	May,Aug,Sep
Eastern Phoebe Sayornis phoebe	C	r	r					May - Aug incl.	Apr,May
Great Crested Flycatcher Myiarchus crinitus		r	r					Jun,Jul,Aug	May,Jun

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Eastern Kingbird Tyrannus tyrannus	C	u	u	u				May - Aug incl.	May,Aug,Sep
Horned Lark Eremophila alpestris				vr					
Tree Swallow Iridoprocne bicolor	C	c	c			FP		May - Aug incl.	Apr,May,Aug
Northern Rough-winged Swallow Stelgidopteryx ruficollis		vr	vr						May,Jun
Bank Swallow Riparia riparia		vr							May
Cliff Swallow Petrochelidon pyrrhonota	C	vr	vr					Jun,Jul,Aug	May,Jun
Barn Swallow Hirundo rustica	C	u	u	r				May - Aug incl.	Apr,May,Aug, Sep

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Gray Jay Perisoreus canadensis		u	u	u	u	S	S	year-round	
Blue Jay Cyanocitta cristata		c	c	c	c	MW	H MW FP	year-round	
American Crow Corvus branchyrhynchos		u	u	u	u		S	year-round	
Common Raven Corvus corax	C	u	u	u	u	He	S MW	year-round	
Black-capped Chickadee Parus atricapillus		c	c	c	c	H He MW S	H He MW S FP B	year-round	
Boreal Chickadee Parus hudsonicus		u	u	u	u	S	S MW He B	year-round	

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Red-breasted Nuthatch Sitta canadensis		u	u	u	u-r	He	S MW He	year-round	
White-breasted Nuthatch Sitta carolinensis		u	u	u	r	H FP	H MW He FP	year-round	
Brown Creeper Certhia familiaris		u	u	u	u	He	H MW He FP	year-round	
Winter Wren Troglodytes troglodytes		r	r	r				May - Sep incl.	Apr,May
Golden-crowned Kinglet Regulus satrapa		u	u	u	u	He	H MW S He	year-round	
Ruby-crowned Kinglet Regulus calendula		c	c	c		M W S He		May - Aug incl.	Apr,Aug,Sep

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE Spring	Summer	Fall	Winter	HABITAT Summer	Winter	Resident	Visitor/ Transient
Veery Catharus fuscescens	C	u	c	u		MW H		Apr - Aug incl.	Apr,Sep
Gray-cheeked Thrush Catharus minimus		one record							
Swainson's Thrush Catharus ustulatus	C	u	c	u		MW S He		Jun,Jul,Aug	May,Aug,Sep
Hermit Thrush Catharus guttatus	C	c	c	c	r	H MW S He		Jun - Sep incl.	Apr,May,Sep
Wood Thrush Hylocichla mustelina		vr	vr	vr				Jun - Nov incl.	May,Jun
American Robin Turdus migratorius	C	c	c	c	r	H MW FP		Apr - Sep incl.	Mar,Apr,Sep - Dec incl.
Gray Catbird Dumetella carolinensis	C	u	u	u		FP		Jun - Sep	Mar - Jun incl., Sep, Oct

Table K-1 (cont.)   Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE				HABITAT		Resident	Visitor/ Transient
		Spring	Summer	Fall	Winter	Summer	Winter		
Northern Mockingbird Mimus polyglottos		vr	vr						May - Aug incl.
Water Pipit Anthus spinoletta				vr					Oct
Bohemian Waxwing Bombycilla garrulus									
Cedar Waxwing Bombycilla cedrorum	C	u	u	r				Jun,Jul,Aug	May,Jun,Sep, Oct
Northern Shrike Lanius excubitor		vr		vr	vr				Nov,Dec
European Starling Sturnus vulgaris	C	u	u	u	r	FP		year-round	
Solitary Vireo Vireo solitarius	C	c	c	c		H MW S He		May - Sep incl.	May,Sep,Oct
Philadelphia vireo Vireo philadelphicus		vr	vr					May - Sep incl.	May

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	ABUNDANCE					HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Red-eyed Vireo Vireo olivaceus	C	c	c	c		H MW FP		Jun - Sep incl.	May,Jun,Sep, Oct
Tennessee Warbler Vermivora peregrina		r	r					May - Sep incl.	May
Nashville Warbler Vermivora ruficapilla		u	u	u		S		May - Aug incl.	May,Sep
Northern Parula Parula americana	C	c	c	u		H MW He FP		Jun - Sep incl.	May,Sep
Yellow Warbler Dendroica petechia		u	u	r		FP		Jun,Jul,Aug	May,Aug,Sep
Chestnut-sided Warbler Dendroica pensylvanica	C	u	c	r		MW		Jun,Jul,Aug	May,Aug,Sep, Oct
Magnolia Warbler Dendroica magnolia		u	c	u		MW S B He		May - Aug incl.	May,Aug,Sep

Table K-1 (cont.)   Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Cape May Warbler *Dendroica tigrina*		vr	vr	vr				Jun - Sep incl.	
Black-throated Blue Warbler *Dendroica caerulescens*	C	u	u	u		H MW		May - Aug incl.	May,Aug,Sep
Yellow-rumped Warbler *Dendroica coronata*		c	c	c	r	MW S		May - Sep incl.	Apr,May,Sep - Dec incl.
Black-throated Green Warbler *Dendroica virens*		u	c	u		MW S He		May - Aug incl.	May,Sep,Oct
Blackburnian Warbler *Dendroica fusca*		u	u	u		MW He		Jun,Jul,Aug	May,Aug,Sep
Palm Warbler *Dendroica palmarum*	C	c	c	c		S B		May - Sep incl.	Apr,May,Sep, Oct
Bay-breasted Warbler *Dendroica castanea*		r	r	r		He		Jun,Jul,Aug	May,Aug,Sep

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE				HABITAT		Resident	Visitor/ Transient
		Spring	Summer	Fall	Winter	Summer	Winter		
Blackpoll Warbler *Dendroica striata*		u	r	r				May - Oct incl.	May,Oct
Black-and-White Warbler *Mniotilta varia*	C	u	c	u		H MW FP S		Jun,Jul,Aug	May,Aug,Sep
American Redstart *Setophaga ruticilla*	C	c	c	r		H MW FP		May - Sep incl.	May
Ovenbird *Seiurus aurocapillus*	C	u	c	u		H MW He		May - Aug incl.	May,Sep
Northern Waterthrush *Seiurus noveboracensis*		r	r	r		FP		May - Aug incl.	May,Aug,Sep
Mourning Warbler *Oporornis philadelphia*		one record							
Common Yellowthroat *Geothlypis trichas*	C	u	u	u		B		May - Sep incl.	May,Sep,Oct

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Wilson's Warbler *Wilsonia pusilla*		vr		vr					May,Aug
Canada Warbler *Wilsonia canadensis*	C	u	u	r		MW FP		May - Sep incl.	
Scarlet Tanager *Piranga olivacea*		r	r					May - Aug incl.	
Rose-breasted Grosbeak *Pheucticus ludovicianus*	C	u	u	vr		H		Jun,Jul,Aug	May,Jun,Aug, Sep
Indigo Bunting *Passerina cyanea*		vr							May
Rufous-sided Towhee *Pipilo erythrophthalmus*		vr	vr						May
American Tree Sparrow *Spizella arborea*				vr	vr				
Chipping Sparrow *Spizella passerina*		r	r	u				Jun - Oct incl.	May,Oct,Nov

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
Field Sparrow Spizella pusilla		vr		vr					
Vesper Sparrow Pooecetes gramineus		vr	vr						
Savannah Sparrow Passerculus sandwichensis		r	r					May - Aug incl.	Apr,May
Fox Sparrow Passerella iliaca		r	r		r			Apr - Sep incl.	Apr,Sep,Oct
Song Sparrow Melospiza melodia	C	u	u	u				Apr - Sep incl.	Mar,Apr,Sep, Oct,Nov
Lincoln's Sparrow Melospiza lincolnii			vr	vr					Jun - Nov incl.
Swamp Sparrow Melospiza georgiana	C	u	u	u		B		May - Sep incl.	Apr,May,Sep, Oct
White-throated Sparrow Zonotrichia albicollis	C	u	u	u	r	MW S		May - Sep incl.	Apr,May,Sep, Oct

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES		ABUNDANCE				HABITAT			
	Breeding Status	Spring	Summer	Fall	Winter	Summer	Winter	Resident	Visitor/ Transient
White-crowned Sparrow *Zonotrichia leucophrys*				vr		S MW He B			
Dark-eyed Junco *Junco hyemalis*	C	c	c	c	r			year-round	
Snow Bunting *Plectrophenax nivalis*				r-u	r-u				
Bobolink *Dolichonyx oryzivorus*		vr							May
Red-winged Blackbird *Agelaius phoeniceus*	C	u	u	u				Apr - Aug incl.	Mar, Apr, Sep, Oct
Eastern Meadowlark *Sturnella magna*			one	record					
Rusty Blackbird *Euphagus carolinus*	C	u	u	u				Apr - Sep incl.	Mar, Apr, Sep, Oct

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE				HABITAT		Resident	Visitor/ Transient
		Spring	Summer	Fall	Winter	Summer	Winter		
Common Grackle *Quiscalus quiscula*	C	u	u	u		FP		Apr - Oct incl.	Mar,Apr,Sep, Oct
Brown-headed Cowbird *Molothrus ater*	C	u	u	u	r			year-round	
Northern Oriole *Icterus galbula*	C	vr	vr					May - Aug incl.	May
Pine Grosbeak *Pinicola enucleator*		r	r	r	r		S MW He B	year-round	
Purple Finch *Carpodacus purpureus*	C	u	u	u	r	H MW		year-round	
Red Crossbill *Loxia curvirostra*		r	r	r-u	r-u		S B He	year-round	
White-winged Crossbill *Loxia leucoptera*		r	r	r-u	r-u		S B He	year-round	

Table K-1 (cont.) Birds of Kejimkujik National Park

SPECIES	Breeding Status	ABUNDANCE Spring	Summer	Fall	Winter	HABITAT Summer	Winter	Resident	Visitor/ Transient
Common Redpoll *Carduelis flammea*					vr				Jan,Dec
Pine Siskin *Carduelis pinus*		r	vr	r	r-u		S He	year-round	
American Goldfinch *Carduelis tristis*		u	u	u	r			year-round	
Evening Grosbeak *Hesperiphona vespertina*		vr	r	u	u			year-round	
House Sparrow *Passer domesticus*		vr	vr	vr	vr			year-round	

Addendum

Great Cormorant *Phalacrocorax carbo*				one record					

Evaluation:

Lunn (1973) has identified a number of areas in the Park as being of a sensitive nature with regard to the avifauna. These areas (Figure K-1) include important feeding and/or nesting habitat for a number of species.

Management Objectives:

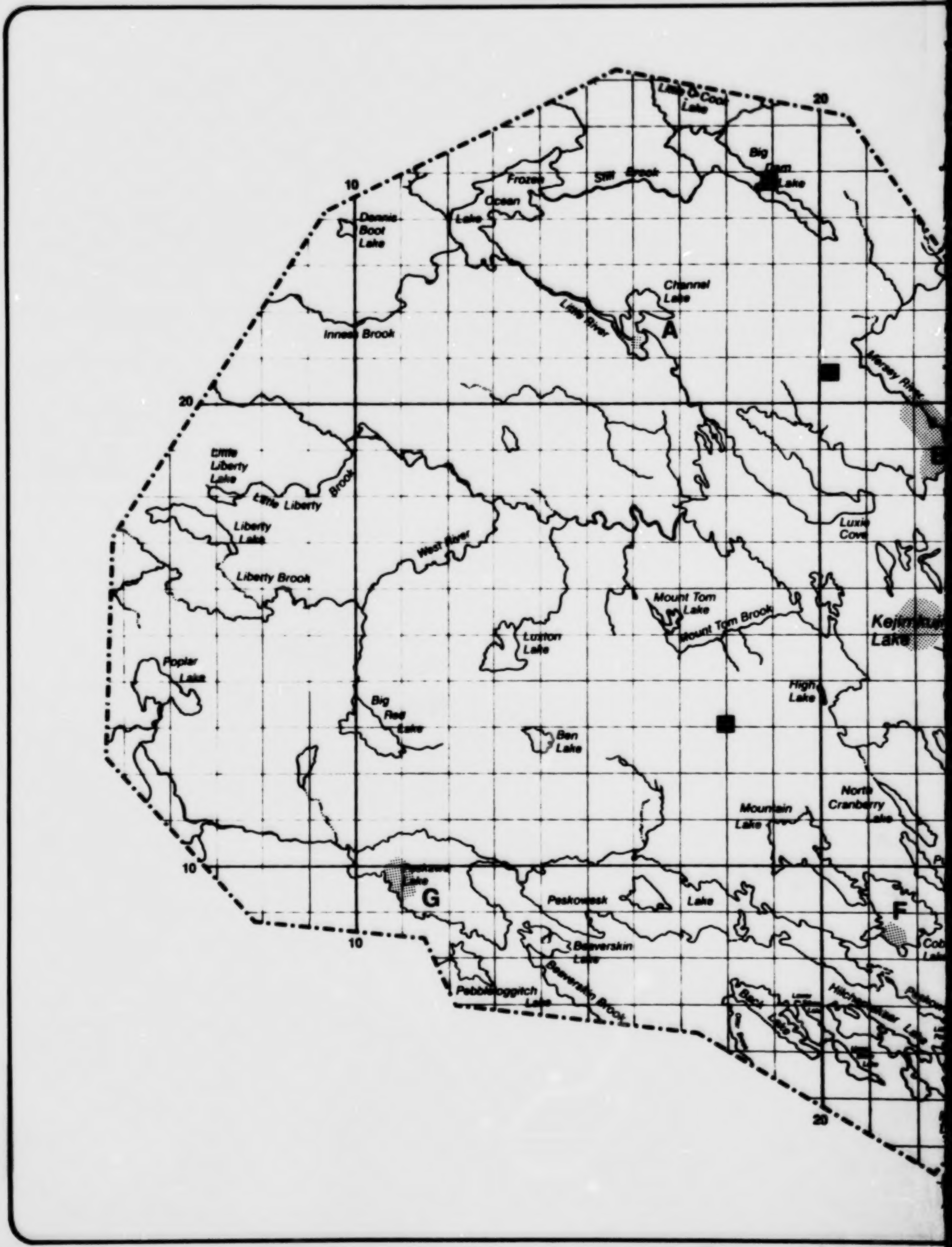
1. To locate and protect important and sensitive nesting and/or feeding areas.

2. To monitor and, where necessary, provide for appropriate protection for important bird species.

3. To continue to gather data on the avifauna of the Park to update current knowledge and to allow the assessment of long-term changes in avifaunal populations.

Species Status:

The status of each of the species of birds occurring in Kejimkujik National Park has been identified by Hope (1983) and this information has been incorporated in Table K-1. It is possible that the status of some species may change as more observations (particularly in the late summer and fall) are collected.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Still Brook
Frozen
Ocean
Lake
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Dennis Boot Lake
Channel Lake
Little River
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Innes Brook
Mersey River
20
Little Liberty Lake
Little Liberty
Brook
Liberty Lake
Liberty Brook
West River
Luxie Cove
Mount Tom Lake
Mount Tom Brook
Kejimkujik Lake
Luxton Lake
Poplar Lake
High Lake
Big Red Lake
Ben Lake
North Cranberry Lake
Mountain Lake
10
Lake
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Cob
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Beaverskin Lake
Beaverskin Brook
Pebbleloggitch Lake
Back Lake
Hitchenmeker Lake
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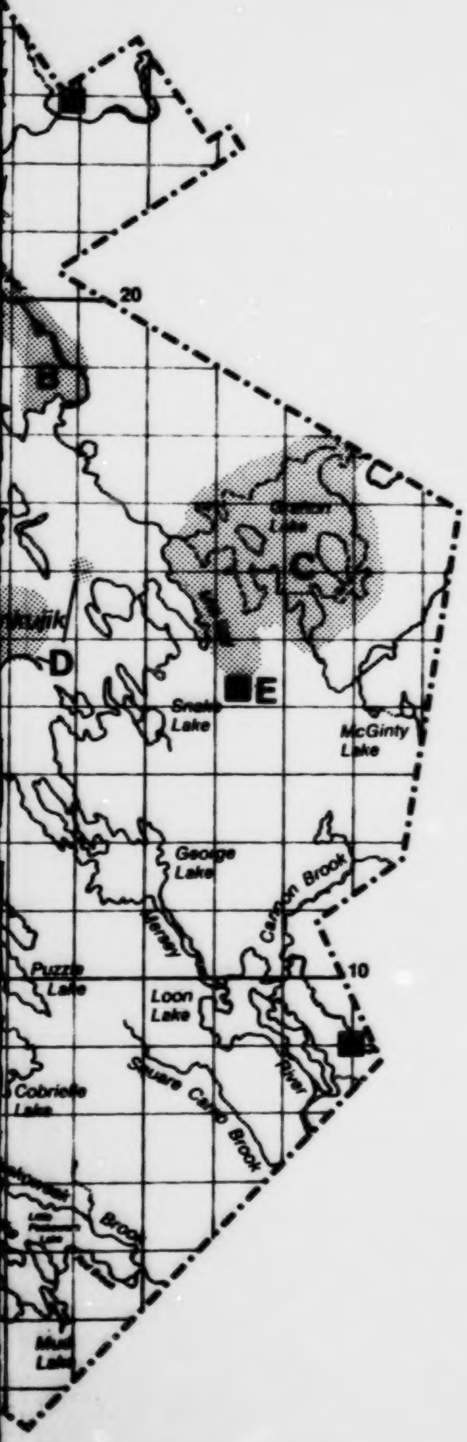
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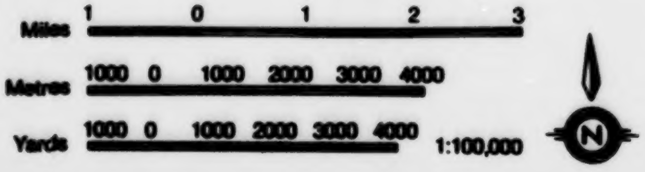
Snake Lake
McGinty Lake
George Lake
Cannon Brook
Mersey
10
Puzzle Lake
Loon Lake
Cobrielle Lake
Square Camp Brook
River
Brook
Mud Lake

Figure K-1

▨	Sensitive Areas for Birds
A	Barn Swallow Colony (natural habitat)
B	Floodplain (feeding habitat)
C	Nesting Area: Osprey
D	Nesting Area: Common Tern, Great Black-backed Gull
E	Scarlet Tanager habitat
F	Nesting Area: Great Black-backed Gull
G	IMPORTANT ISLAND NESTING HABITAT
■	Study Plots established by Lunn (1973)

Kejimkujik National Park

Parks Canada Atlantic Region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Species of Significance:

Nineteen species of birds occurring in Kejimkujik National Park could be considered of significance. These species are listed, with their status in the Park and in the province, in Table K-2. Also given is the reason that the species is listed. Thirteen of the species in Table K-2 are listed in a Preliminary List of Rare Birds in Nova Scotia (Isnor, 1981) and future studies may add to or subtract from this list. Thus Table K-2 may be subject to future revisions. Some species considered rare in the Park are not necessarily rare in Nova Scotia.

Resource Management Concerns:

1. Increasing acidification of Park waters as a result of acid precipitation may, in the future, affect the productivity of lower levels of the food chain. This, in turn, could affect the food supply of the Park's aquatic avifauna. Species such as Common Loon (Table K-3), Great Blue Heron, and Osprey would be affected by depleted fish populations while Great Blue Heron and American Bittern would be affected by reduced amphibian populations. Similarly, Spotted Sandpiper and other shorebirds would be affected by depleted invertebrate populations.

2. Nests of Common Loon, Osprey, Great Black-backed Gull and Common Tern are particularly susceptible to human disturbance. Uncontrolled access to these nest areas during the breeding season could adversely affect the breeding success of these species.

Table K-2 Species of Significance in Kejimkujik National Park

SPECIES	STATUS		REASON
	K.N.P.	N.S.	
Common Loon	Common	Common	Sensitive to nest disturbance
Osprey	Rare	Uncommon	Sensitive to nest disturbance
Cooper's Hawk	Very rare	Visitant	COSEWIC - rare in Canada
Great Black-backed Gull	Uncommon	Common	Sensitive to nest disturbance
Common Tern	Uncommon	Common	Sensitive to nest disturbance
Mourning Dove	Uncommon	Uncommon	Isnor, 1981
Pileated Woodpecker	Uncommon	Rare	Isnor, 1981
Eastern Phoebe	Rare	Rare	Isnor, 1981
Great Crested Flycatcher	Rare	Rare	Isnor, 1981
Wood Thrush	Very rare	Rare	Isnor, 1981
Scarlet Tanager	Rare	Rare	Isolated occurrences in Park
Northern Oriole	Very rare	Rare	Isnor, 1981 (limited range)
Wood Duck	Rare	Rare	Limited nesting habitat
Hooded Merganser	Rare	Rare	Limited nesting habitat

Table K-3 Number of Broods of Common Loon by Location, Kejimkujik National Park

Notes:

1. **B** Benchmark lakes monitored regularly by Wilderness Patrol

2. **S** Study lakes monitored as manpower permits

3. Figure in parentheses indicates number of surveys per month.

Table K-3 (cont.) Number of Broods of Common Loon by Location Kejimkujik National Park

	LAKE	1973	1974	1975	1976	1977	1978
	Back					1	
B	Beaverskin						
	Ben						
B	Big Dam						
	Channel				1		
B	Cobrielle						
B	Frozen Ocean			1			1
	George						1
S	Grafton						
	Hilchemakaar	1			2		
S	Kejimkujik						
	Eastern Shore						
	Fairy Bay						
	Forrest Island						
	Hemlock Island						
	Jeremys Bay			1			
	Little River Bay					1	
	Minard's Bay			1			
	Mill Bay						
	Mt. Thom Bay						
	West River Bay						
	Unspecified loc.		1	1	1		
	Liberty						
S	Loon				1	1	
	Lower Silver						
B	Mountain						
	Pebbleloggitch						
B	Peskawa			1			
B	Peskowesk		1	1			
	Puzzle						1
	Upper Silver						
	TOTAL BROODS/YEAR	1	2	6	5	3	3

Table K-3 (cont.) Number of Broods of Common Loon by Location, Kejimkujik National Park

	LAKE	1979	1980	1981	1982	1983
	Back				(4)	
B	Beaverskin				1	1(4)
	Ben					
B	Big Dam		1		1(8)	1(16)
	Channel				(8)	(12)
B	Cobrielle	1		1	(4)	(6)
B	Frozen Ocean	1	1		2(12)	(16)
	George				(8)	(10)
S	Grafton	1				1(2)
	Hilchemakaar	1			(4)	(2)
S	Kejimkujik					
	Eastern Shore				1	
	Fairy Bay				1(0)	
	Forrest Island			1	1	
	Hemlock Island				(4)	(4)
	Jeremys Bay		1	1	1(0)	(4)
	Little River Bay	1			1(8)	1(16)
	Minard's Bay		1		(8)	1(4)
	Mill Bay					
	Mt. Thom Bay					(4)
	West River Bay				(8)	1(4)
	Unspecified loc.				1	1
	Liberty				(0)	(1)
S	Loon			1	1(8)	(8)
	Lower Silver				(4)	(2)
B	Mountain		2		1(8)	1(10)
	Pebbleloggitch					(2)
B	Peskawa				(12)	1(10)
B	Peskowesk				(8)	1(10)
	Puzzle				(4)	(4)
	Upper Silver				(4)	(2)
	TOTAL BROODS/YEAR	6	7	4	12	10

Table K-3 (cont.) Number of Broods of Common Loon by Location
Kejimkujik National Park

	LAKE	1984	1985	1986	1987	1988
	Back					
B	Beaverskin	1(2)	(3)			
	Ben					
B	Big Dam	(8)	1(8)			
	Channel	(2)	(1)			
B	Cobrielle	1(1)	1(2)			
B	Frozen Ocean	1(16)	(16)			
	George	1(1)				
S	Grafton	1(1)				
	Hilchemakaar					
S	Kejimkujik					
	Eastern Shore					
	Fairy Bay					
	Forrest Island					
	Hemlock Island					
	Jeremys Bay	1(1)	1			
	Little River Bay	(3)	1			
	Minard's Bay	1				
	Mill Bay					
	Mt. Thom Bay					
	West River Bay	(1)				
	Unspecified loc.	1(12)	2(13)			
	Liberty	(1)	(0)			
S	Loon	1(1)	1(2)			
	Lower Silver					
B	Mountain	1(7)	1(6)			
	Pebbleloggitch					
B	Peskawa	(3)	(4)			
B	Peskowesk	2(7)	(5)			
	Puzzle	(1)	1			
	Upper Silver	1				
	TOTAL BROODS/YEAR	13	9			

Research Requirements:

1. The study areas established by Lunn (1971, 1973) (Figure K-1) are mainly located in the eastern half of the Park. Similarly, most wildlife observation cards and nest record cards are from the eastern section of the Park. Largely because of its remoteness and relatively low levels of use there is a paucity of observations from that area of the Park south of Frozen Ocean Lake to the fire tower and west to the western boundary of the Park. Therefore, additional plots, based on Lunn's (1971) methods, should be established in this area of the Park. These plots should be monitored regularly but not necessarily annually.

2. The status of those species in Table K-2 should be monitored annually to determine if they are being adversely affected by environmental or human influences.

3. Current data collection methods should be continued and the survey plots established by Lunn (1971, 1973) should be surveyed on a regular basis to determine any changes in breeding patterns of species in those areas. More bird observations are required for the late summer and autumn periods to supplement existing knowledge of fall movements of birds through the Park.

4. Field work for the Maritimes Breeding Bird Atlas is to commence in 1985. Censusing for this atlas is based on 10 km x 10 km squares and the Park will overlap several of these. Co-operation, in the form of logistics and personnel, between the Park and the atlas organizers would be mutually beneficial.

Recommendations for Management:

1. Grafton Lake has been identified as an important habitat for aquatic birds and particularly as an area in the Park where Osprey nest has been recently documented. Access to areas where Osprey are found to be nesting should be controlled during the breeding season to prevent unnecessary disturbance of this species.

2. The Common Loon is particularly sensitive to disturbance at the nest during the breeding season. Loon populations should continue to be monitored (Table K-3) using standardized sampling methods. Nesting habitat should be given appropriate protection from human disturbance.

3. The rock islands in Peskawa, Cobrielle and Kejimkujik Lakes are annual nest sites for Great Black-backed Gull. The gravel bar between Ell Island and Peale Island in Kejimkujik Lake is used annually by nesting Common Tern. These areas are susceptible to human disturbance during the breeding season. Therefore Park users should be discouraged from landing on these islands during the breeding season.

Opportunities:

The avifauna of Kejimkujik National Park is relatively numerous and easily observed. Consequently birds offer a number of opportunities for interpretation to the Park visitor. Aspects of ecology and bird behaviour can be readily demonstrated using Park species as examples. In addition, the predatory nature of certain bird species can be used to demonstrate the importance of a balanced ecosystem.

Birding is a recognized recreational pastime of many Park visitors and, although the Park does not offer any bird "spectacles" or "hot" viewing spots, the relative scarcity of some species offers a challenge to the viewing public seeking to observe the particular species. The call of the Loon is considered by many visitors to be an important part of their stay in the Park. Although no one location in the Park is a prime spot for bird watching, the flood-plain and boardwalk at Jake's Landing, the Grafton Lake Trail, the Rogers' Brook Trail and Slapfoot Trail are all areas of mixed habitat that provide good bird watching.

The position of birds at or near the top of numerous food chains makes them useful environmental indicators. The relatively undisturbed nature of a large portion of the Park lends itself to research on bird species in a natural and undisturbed environment.

Limitations:

Some bird species, as outlined above, are particularly susceptible to environmental and human influences. The effects of acid precipitation are detrimental to the food supplies of certain species. Similarly some species are sensitive to disturbance of the nest by humans during the breeding season.

Park Resource Conservation staff (Bacon, 1982-85; Augustine, 1979; Lohnes, 1977) located Common Loon nest sites on a number of Park lakes. There is indication that some of these sites are re-used annually. While it is not possible to map all nesting areas, those documented should be considered sensitive to impact from human disturbance.

The remoteness of certain parts of the Park limits the amount of data on birds that can be accumulated from those areas unless specific studies are designed for the areas.

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MAMMALS

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Description:

Inventories carried out at Kejimkujik National Park have indicated Kejimkujik has forty-two species of mammals, with a full range of sizes and habitat needs. Thirty-one of these species are common in the Park, and are characteristic of southwestern Nova Scotia. Six additional species are present but rare, restricted by habitat or interspecific relationships. Five species may be present but as yet are unconfirmed. Five species that were once native to the area have been extirpated, probably by hunting and trapping pressure.

Table L-1 gives a brief description of the habitat and status of each species.

Table L-1

Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Order Insectivora Family Soricidae			
Common Shrew (*Sorex cinereus*) Kerr (Grey, Masked or Red-backed Shrew	Found in most habitat types, but most frequently seen along stream and river banks.	Common	
Short-tailed Shrew (*Blarina brevicauda*) Say	Moist areas, old fields, brushland, early successional forests. Shares habitat with Meadow Vole.	Common	The most common shrew in the Park.
Water Shrew (*Sorex palustris*) Richardson	Moist or wet habitats.	Common	
Smokey Shrew (*Sorex fumeus*)	Little is known of the habitat preference in Kejimkujik National Park.	Uncommon	Only 1 specimen collected. Resembles common shrew.
Pygmy Shrew (*Microsorex hoyi*)	Little is known of its habitat in Eastern Canada.	Unconfirmed	Samples taken in 1972/73 adjacent to the Park. Strongly suspected in Park.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Family Talpidae			
Star-Nosed Mole (*Condylura cristata*) Linnaeus	Moist or wet habitats.	Common	More fossorial than shrews, carnivorous.
Order Chiroptera Family Vespertilionidae			
Little Brown Bat (*Myotis lucifugus*) LeConte	Open fields	Common	Dormant in winter.
Long-eared Bat (*Myotis keenii*), *Merriam*, *Keens* bat, Eastern Long-eared Bat, Troussart's Bat, Bay's Bat	Remote, forested areas.	Common	Dormant in winter.
Eastern Pipistrelle Bat (*Pipistrellus subflavus*) Cuvier	Forested areas, caves.	Uncommon	Dormant in winter.
Red Bat (*Lasiurus borealis*) Muller	All habitat types.	Unconfirmed	Probably migratory visitor.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Hoary Bat (*Lasiurus cinereus*)Beauvois	Coniferous forests.	Unconfirmed	This large (35 cm) bat may be a migratory visitor.
Silver-Haired Bat (*Lasionycteris noctivagans*)	Forested areas near lakes and streams.	Unconfirmed	One specimen was taken near the Park. May be a migratory visitor.
Order Lagomorpha Family Leporidae			
Snowshoe Hare (*Lepus americanus*) Erxleben	Most habitat types, prefers early successional stage forests.	Common to Abundant	Subject to cyclic population changes and predator influences.
Order Rodentia Family Scuiridae			
Red Squirrel (*Tamiascuirus hudsonicus*) Erxleben	Medium to old-growth softwood stands.	Common	Cyclic population changes may correspond to conifer cone abundance.
Eastern Chipmunk (*Tamias striatus*) Linnaeus; Ground Squirrel	Hardwood and mixed forests.	Common	

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Southern Flying Squirrel (*Glaucomys volans*) Linnaeus	Hardwood forests.	Uncommon to Rare	Kejimkujik National Park population appears disjunct from the main North American population; active nocturnally.
Northern Flying Squirrel (*Glaucomys sabrinus*) Shaw	Moist coniferous and mixed forests.	Common	Active nocturnally.
Woodchuck (*Marmotta monax*) Linnaeus; Groundhog	Old fields, roadsides.	Uncommon	Sightings have been made but no specimens have been collected.
Family Castoridae			
Beaver (*Castor canadensis*) Kuhl	Lakes and streams.	Common	
Family Cricetidae			
Red-backed Mouse (*Clethrionomys gapperi*)	Mixed forests, Red Oak stands.	Common	Cyclic population.
Meadow Vole (*Microtus pennsylvanicus*) Ord; Meadow Mouse	Open habitat (grassy river islands and banks, river flood plains).	Common	Cyclic population.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
White-footed Mouse (*Peromyscus leucopus*)	Forested areas.	Common	Cyclic population. Kejimkujik National Park disjunct from normal range.
Deer Mouse (*Peromyscus maniculatus*) Wagner; Wood Mouse	Hardwood and mixed forests.	Common	Cyclic population.
Cooper's Lemming Mouse (*Synaptomys cooperi*) Baird; Southern Lemming Mouse	Damp bogs and meadows.	Abundant to rare	Highly variable population.
Muskrat (*Ondatra zibethicus*) Linnaeus; Marsh Rat	Stillwater portions of rivers and streams.	Locally common	Cyclic population, den and house dwellers, restricted by suitable habitat.
Family Muridae			
Norway Rat (*Rattus norvegicus*) Berkenhout	Usually found in association with man-made structures.	Common	Introduced.
House Mouse (*Mus musculus*) Linnaeus	Usually found in association with man-made structures	Locally Abundant	Introduced.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Family Zapodidae			
Meadow Jumping Mouse (Zapus hudsonius) Zommermann	Old fields, grassy and sedgy stream borders.	Common	A true hibernator; it remains dormant throughout most of the winter.
Woodland Jumping Mouse (Napeozapus insignis) Miller	Heavily forested areas.	Common	
Family Erithizontidae			
Porcupine (Erithizon dorsatum) Linnaeus	Uses forest habitat, also roadside grassy areas.	Common	One of the most conspicuous forms of wildlife in the Park.
Order Carnivora Family Canidae			
Red Fox (Vulpes vulpes)	The edge of human habitation.	Common	An old denning site has existed near Fairy Bay.
Coyote (Canis latrans) Say	Adapts well to any habitat.	Present	First sighted September 8, 1985.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Family Ursidae			
Black Bear (*Ursus americanus*) Pallas	All habitat types.	Common	A pest historically, successful management has resulted in fewer problems in recent years.
Family Procyonidae			
Raccoon (*Procyon lotor*) Linnaeus	All habitat types.	Common to Abundant	Raccoons are a periodic problem in the Park campground disturbing garbage and foodstuffs.
Family Mustelidae			
Ermine (*Mustela erminea*) Linnaeus; Short-tailed Weasel	Woodlands.	Common	Extensively trapped in the early 1900's, the ermine has become re-established.
Mink (*Mustela vison*) Schreber	Lake and stream routes.	Common	Travels extensively.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Otter (*Lutra canadensis*) Schreber	Lake and stream routes.	Common	Travels extensively.
Fisher (*Martes pennanti*) Erxleben	Deep forest habitats.	Uncommon to Rare	Reduced by trapping in early 1900's, reintroduced to Tobeatic Sanctuary, may have become re-established in Kejimkujik National Park.
Marten (*Martes americana*) Turton	Boreal coniferous forest.	Extirpated	Some suitable habitat. Reintroduction should be considered.
Striped Skunk (*Mephitis Mephitis*) Schreber	All habitat types, prefers border of human habitation.	Undetermined	Eradicated from much of western N.S. by distemper. Currently moving southwestwardly across province.
Family Felidae			
Bobcat (*Lynx rufus*) Schreber; Wildcat	All habitat types.	Common	Rare sightings are the result of its secretive nature. Cyclic population fluctuations occur in association with snowshoe hare populations. Bobcats actively trapped near Park boundaries.

Table L-1 (cont.) Status and Habitat Use for Mammals of Kejimkujik National Park

Species	Habitat	Status	Comments
Lynx (*Lynx canadensis*) Linnaeus	All habitat types.	Probably extirpated	Competes with Bobcat for prey.
Cougar (*Panther catamount*) Linnaeus	Deep-woods habitat.	Probably extirpated	Status in the Maritimes is undetermined. Some unsubstantiated sightings.
Order Artiodoctyla Family Cervidae			
White-tailed Deer (*Odocoileus virginianus*)	Hardwood and mixed forests.	Population abundant locally	Use Main Park road corridors extensively. Popular visitor attraction.
Moose (*Alces alces*) Linnaeus	Bogs, marshes, early successional stage forests.	Uncommon	Population inhibited by deer-moose interaction, described in detail in the Resource Management Concerns section. Sightings reported periodically near Peskowesk Lake. Significant population on lands adjacent to Park (Tobeatic Sanctuary).

Evaluation:

Management Objectives:

1. To maintain natural mammal species composition in Kejimkujik National Park, while allowing inherent population fluctuations to occur.

2. To protect critical mammalian habitat areas through zoning, or other appropriate methodologies.

3. To continue determination of present mammalian species status, and to identify trends in population dynamics, range and habitat use for mammals of special interest.

4. To re-introduce extirpated species where feasible, with consideration given to the full understanding of impact, habitat requirements and general population dynamics of the species being re-introduced.

5. To minimize conflict between mammals and Park visitors, and where a problem occurs, take action based on public safety, species status and other relevant factors.

6. To manage mammal species by manipulation only when non-manipulation would result in serious, long-term detrimental effects on the species status in question, or on other significant Park values.

Species of Significance:

Eighteen mammal species have been identified as significant in the Kejimkujik area. Some of these species are significant because they are becoming increasingly rare or localized. Several of the species find the limits of their range at Kejimkujik, and some others are quite isolated from their normal range. Also included in this section are several species whose presence in the Park has not been verified but is suspected.

Moose

The Moose is the largest member of the deer family and is indigenous to Nova Scotia. Its preferred habitat is intermediate stage successional forest interspersed with lakes and streams (Peterson, 1966). The Moose population in Kejimkujik has decreased due to possible competition with the White-tailed Deer, hunting pressure, restricted choice of habitat, and the parasite *Paralaphstrongylus tenuis* carried by the White-tailed Deer. The last complete census of the Moose population in Kejimkujik was an aerial survey conducted in February of 1971 (Wood, 1973).

Smokey Shrew

Only one specimen has been recorded in Kejimkujik, and Wood (1973) suggests that it is uncommon in the Park. It can be distinguished from the Common Shrew on the basis of its coloration; the stomach of the Smokey Shrew is only slightly paler coloured than its back; while the Common Shrew has a pale stomach. The Smokey Shrew reaches the northern limits of its range in Nova Scotia (Peterson, 1966).

Pygmy Shrew

The Pygmy Shrew may weigh no more than a ten-cent piece when fully mature, and resembles a small Common Shrew. Kejimkujik is included in the Pygmy Shrew's range, yet no specimens have been recorded in the Park. The lack of specimens may be due more to the difficulty in capturing the shrew than to its lack of abundance. Further investigation is required to verify its presence in the Park as it has been found in the adjacent area.

Silver-haired Bat

The Silver-haired Bat is a migratory visitor to eastern Canada, and an infrequent visitor to Nova Scotia (one specimen in 1965). It prefers forested areas near lakes and streams and is most commonly seen alone (Peterson, 1966). Nova Scotia is thought to be at the extreme northeastern limits of its range.

Eastern Pipistrelle Bat

The Eastern Pipistrelle Bat is the smallest species of bat in eastern Canada, and only one specimen has been taken in Kejimkujik. This bat prefers to hibernate in caves, the lack of which limits its habitat in the Park. Kejimkujik is the northeastern extreme of its range.

Hoary Bat

Only three specimens of this large (35 cm) bat have been recorded in Nova Scotia. It is a migratory visitor that prefers coniferous forests, and is at its northernmost range in Nova Scotia.

Southern Flying Squirrel

Two specimens were captured in 1971 in different locations of the Park, suggesting a non-localized population. Before these specimens were recorded, the suspected range of this squirrel extended no farther north than northern Maine; and southern Ontario was the closest known habitat in Canada. It can be distinguished from its cousin, the Northern Flying Squirrel, by its pure white underbelly (as compared to the dusky base of the Northern Flying Squirrel) (Peterson, 1966). The Eastern Flying Squirrel is rarely seen because it is only active nocturnally. It is an omnivore. Its diet consists mainly of seeds, buds, fruits and insects.

White-footed Mouse

The White-footed Mouse has a dark slate-coloured back, and a completely white underbelly and feet. Its status in Kejimkujik varies yearly from common to rare. Its range elsewhere in North America extends only as far as southern Ontario and Quebec, and southern Maine. It resembles the Deer Mouse, but can be distinguished by the lack of a slate-coloured base on the throat and its dusky upper lip.

Southern Lemming Mouse; Bog Lemming

The Southern Lemming Mouse has an extremely variable population, and can be over-abundant some years and rare in others. Researchers found it rarely in Kejimkujik, suggesting either a small population base or sampling problems.

Coyote

Coyotes have been recently (1985) observed in Kejimkujik National Park. However, little data has been collected, and many questions remain concerning population dynamics, feeding habits, and den sites. Coyotes are highly intelligent and may hunt in packs, if it is advantageous. Their primary food source is small mammals, but as pack hunters coyotes could become an important predator of the Park's deer population. This issue is discussed in the Resource Management Concerns section.

Marten

Once abundant in western Nova Scotia, the Marten was apparently extirpated by extreme trapping pressure. It is a versatile predator and is at home in trees, on the ground, and in water. It usually prefers boreal coniferous forest. A reintroduction program may be warranted. Kejimkujik appears to have suitable habitat for Martens including a diverse prey species population base.

Fisher

The Fisher was apparently eliminated from Nova Scotia in the early 1900's by overtrapping, but was re-introduced to the Tobeatic Sanctuary around 1950. A few specimens have been trapped in the North Queens area and one was captured near Grafton Lake, Queens County in the winter of 1968-69, suggesting a limited re-establishment in the area. The Fisher is a deep-wood species, so few observations are to be expected. If Fisher are present in Kejimkujik, the Park is probably used only as a portion of their range.

Striped Skunk

A former resident of southwestern Nova Scotia, the Striped Skunk was reportedly eradicated from the area in the 1920's and 1930's by distemper (Dodds, 1969). The species may be slowly repopulating the southwestern portion of Nova Scotia. A few sightings have been made in Kejimkujik National Park in recent years. Skunks prefer areas of human disturbance and can become a nuisance animal in certain situations.

Cougar

The Cougar reportedly was eliminated from Nova Scotia about one hundred years ago, but unconfirmed reports of sightings are not uncommon in the province. The Cougar is an extremely secretive cat. This fact, taken in light of the sighting reports, warrants inclusion of the Cougar as a possible inhabitant of Kejimkujik.

Canada Lynx

The Lynx is an indigenous cat species in Nova Scotia. It was reported to be abundant in the Kejimkujik area until quite recently. However, the Bobcat appears to have replaced the Lynx in the southern portions of the Lynx's range. Three sightings have been reported in the Park (1969, 1970 and 1984), but the accuracy of these reports may be disputed. The Lynx may be still present in the Park area, but further evidence is required to substantiate this possibility.

Resource Management Concerns:

1. There are indications that the White-tailed Deer population in the more heavily-developed eastern portion of Kejimkujik National Park has undergone significant changes since surveys began in 1972 (Drysdale, 1986). (Fig. L-1.) This may be the result of the elimination of hunting pressure following Park establishment, and the increased availability of winter browse, as abandoned farm fields and new construction disturbance sites (road shoulders, construction push-offs, etc.) were invaded by successional species. While deer numbers in this area have continued to remain high recently, browse supplies have been extensively utilized (Fig. L-2, L-3). A series of recent mild winters, and trapping pressure on Bobcat outside Park boundaries, has continued to influence deer mortality rates. A potential for population decline of White-tailed Deer exists if the Kejimkujik area experiences a series of severe long winters with heavy snow. It is expected that the deer

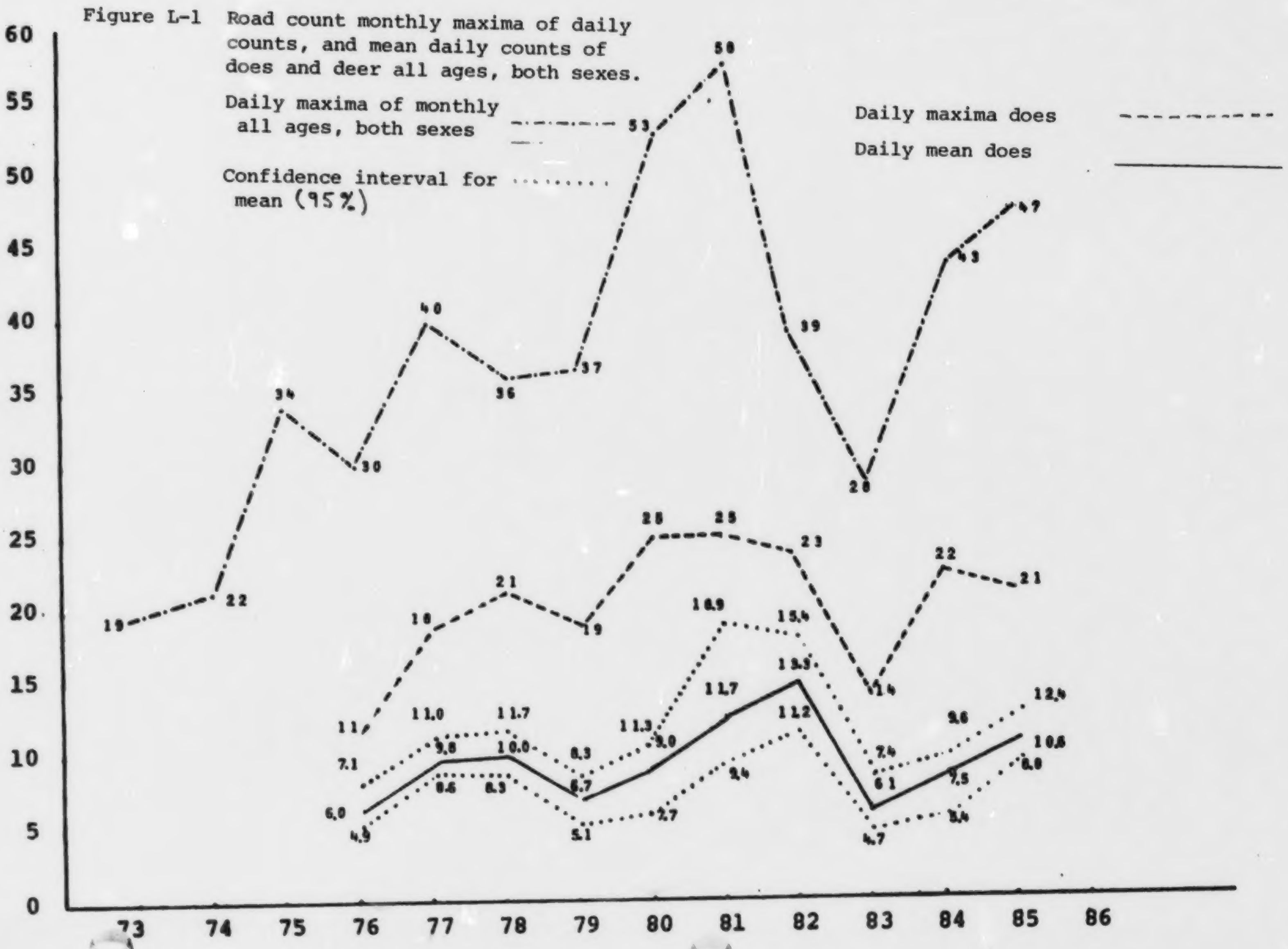

Figure L-1 Road count monthly maxima of daily counts, and mean daily counts of does and deer all ages, both sexes.

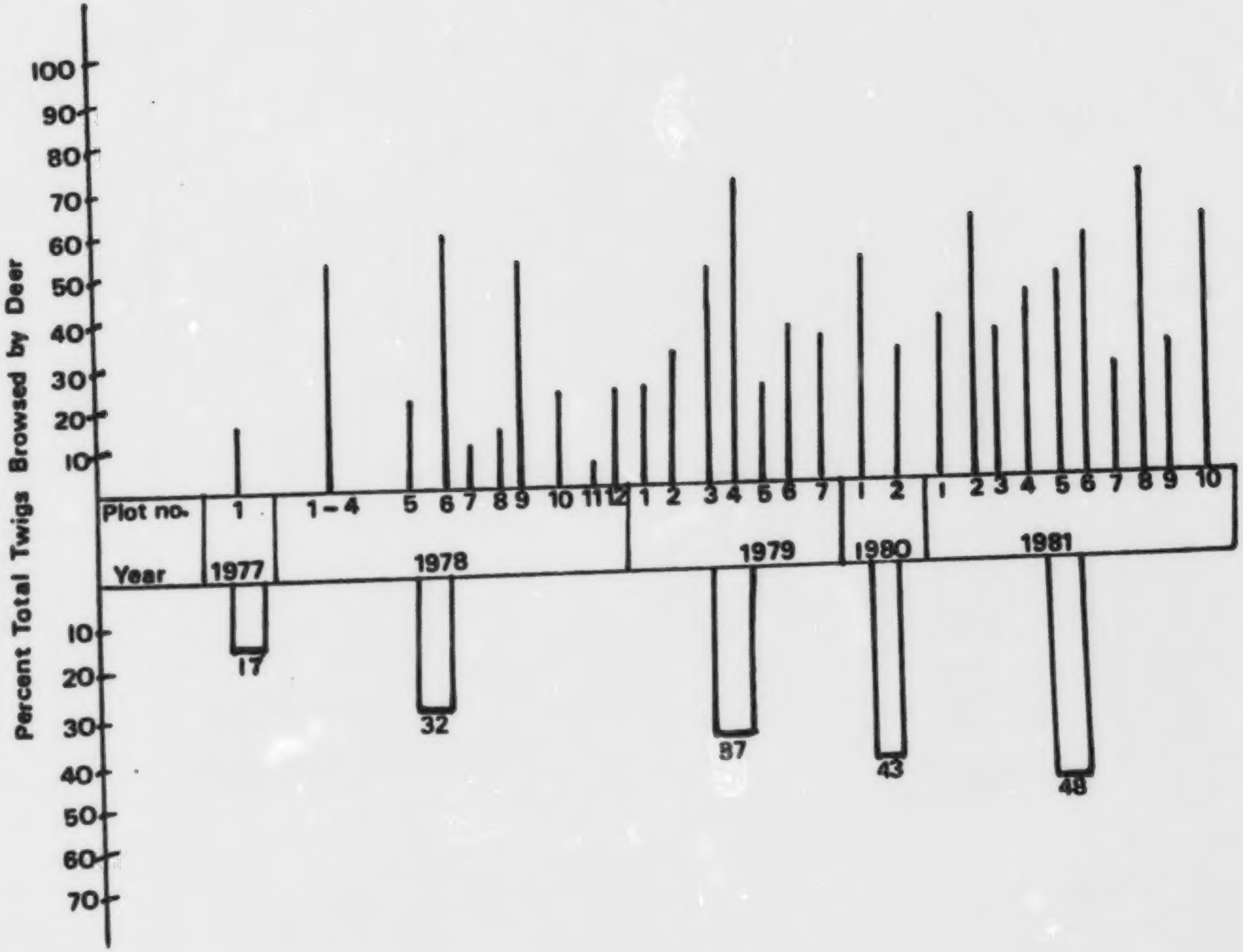

Figure L-2. Summary of browse survey results, 1977-1981.

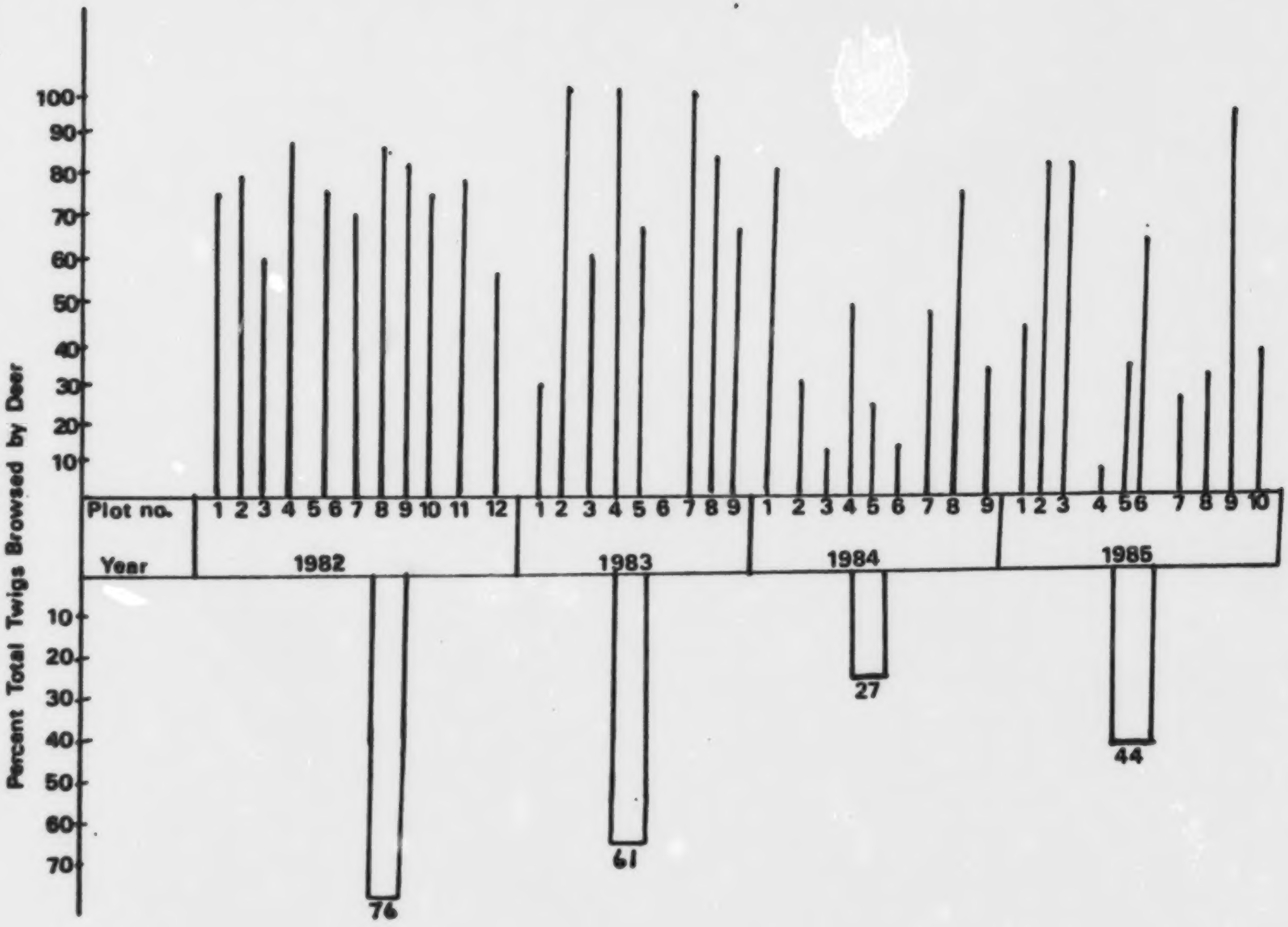

Figure L-3. Summary of browse survey results, 1982-1985.

most directly affected by such a phenomenon will be those utilizing the main Park road corridors and vicinity.

If moderate winter trends continue, however, the deer population in question will probably decline more slowly. Browse species will continue to be heavily used, influencing forest succession towards softwood species. The main campground forest is already demonstrating this phenomenon to the detriment of more impact-tolerant mixed wood stands.

The arrival of the coyote may help control deer numbers. If low snow depth conditions prevail the coyote's influence on deer populations will be considerably reduced.

Deer population densities in the western portion of Kejimkujik are probably lower and thus less likely to undergo a rapid decline following severe winter conditions.

2. The changing human use patterns in the area including Kejimkujik, coupled with increased White-tailed Deer numbers, the arrival of the coyote, and an incomplete mammal inventory, have resulted in the creation of gaps in Parks Canada's knowledge of the mammals in this National Park. The population status of seven

mammal species in the Park, including the Fisher, Coyote, Lynx, Cougar, Pygmy Shrew, Hoary Bat and Silver-haired Bat is also unknown. Similarly the status of the Moose, and its mortality from brainworm (*Paralaphstrongylus tenuis*) as carried by the White-tailed Deer vector is a subject of conjecture.

While the concern is not a critical one, continued efforts should be made by Resource Conservation section to determine the existence and status of these species utilizing standard monitoring techniques.

3. It has been determined that the Fisher and the Marten were found in the Kejimkujik area years ago. While Fisher may now be present, in low numbers, following a re-introduction in the Tobeatic area around 1950, the Marten remains absent. Research on the feasibility of re-introducing both of these animals should proceed as resources permit. Their presence, as interesting predators, and as controls for the occasionally bothersome porcupines would likely be appreciated by Park visitors, and outside forestry concerns alike.

4. Raccoons, because of their cleverness and dexterity, can become campground pests. While raiding garbage pails can cause a litter problem, an artificially-sustained population of garbage-fed raccoons in the Jeremys Bay Campground area could also result in undesirable predation of rare Blanding's Turtle eggs at the nearby Heber Meadow Zone 1 area. Additionally,

garbage-fed raccoons can become quite bold, resulting in a higher potential for humans being bitten. It is therefore recommended that the status of raccoons in the main campground area be monitored, and an appropriate management programme implemented if necessary. Improved garbage can lid securing mechanisms and public education can also reduce the potential for problems.

Research Requirements:

1. It is suggested that habitat evaluation be conducted to assess the feasibility of re-establishing populations of the Pine Marten, and the Fisher to Kejimkujik.

2. As indicated in the "Resource Concerns" section of this document, the population status of seven mammal species including Fisher, Coyote, Lynx, Cougar, Pygmy Shrew, Hoary Bat and Silver-haired Bat is not fully understood. Continued efforts should be made to determine the existence and status of these species, as time and resources permit.

Monitoring Requirements:

1. It is recommended that White-tailed Deer monitoring be continued, including the annual roadside count, and a browse usage study. The dead deer survey should be reinstated (following termination in 1983) if Park Resource Conservation staff suspect drastic changes in deer mortality rates.

2. The arrival of the Coyote in significant numbers to the Kejimkujik National Park area will probably have a measurable impact on prospective prey species status. The nature and extent of this impact would be of public interest, and would be important to know in the context of resource management requirements for mammal species in Kejimkujik. Collection and analysis of scat samples should be carried out as the opportunity permits.

3. It is recommended that previously-established winter track transects continue to be surveyed utilizing standard techniques as identified by Mullen (1978). Appropriate review and refinement of the track transect programme is also desirable. Track transects can provide information on the status of the Coyote, Fisher, Bobcat, and other more common mammals in Kejimkujik.

4. It is recommended that sighting records of notable mammal species including the Black Bear, Moose, Bobcat, Coyote, the Weasel family, Beaver and the uncommon small mammals be maintained. Visitor participation in this undertaking should be encouraged. Proper management of this information, particularly with the aid of computerized data analysis systems, will provide a useful tool for updating species status, and anticipating problems.

Opportunities:

Mammals, perhaps because of their size and visibility, are often of interest to the public. The mammals of Kejimkujik provide many opportunities for recreational viewing and interpretation. Of particular note are the White-tailed Deer seen along Park highways. The population history of these animals reflects the changing uses of Kejimkujik itself. Beaver are common in Kejimkujik also. Easily-seen lodges along the Mersey River near Jakes Landing attract visitor interest, and the animals themselves seem less shy than in more remote areas of the Park. Bobcat scat can often be seen along Park trails throughout the summer, and tracks of many small animals can be observed when snow conditions permit.

The opportunity exists to research the interrelationship between Deer, Moose, and the parasite Paralaphstrongylus tenuis in the southwestern portion of the Park. Similarly the arrival of the coyote and its impact on small and large animals alike is a potential subject for research.

Kejimkujik National Park provides habitat for the Southern Flying Squirrel and the White-footed Mouse. These populations are quite disjunct from those on the mainland of North America, and could be genetically different.

Finally, the opportunity may exist to re-introduce the Fisher, Pine Marten and Lynx to Kejimkujik following appropriate research.

Limitations:

A safe conservation-oriented interface between wild mammals and man depends upon relevant management techniques including habitat protection, good facility planning, development and operation, and appropriate public education.

The protection of mammal habitat from undesirable impact by man is rendered more difficult by incomplete knowledge of the group. Lack of information on animal movement patterns, and specific habitat usage can also limit the ability to plan development and usage of Park resources properly. With the exception of deer, and more sedentary mammals, more knowledge is required concerning Kejimkujik mammal habitat requirements and movements on a daily and seasonal basis within and outside of the Park. Similarly, we have little knowledge concerning population densities and fluctuations.

Public education must further the development of informed and safe attitudes toward the mammals. While feeding roadside deer, and garbage raccoons could become a popular novelty with some Park visitors, these activities can result in problems. Such activities are therefore limitations to good mammal management.

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ARCHAEOLOGY

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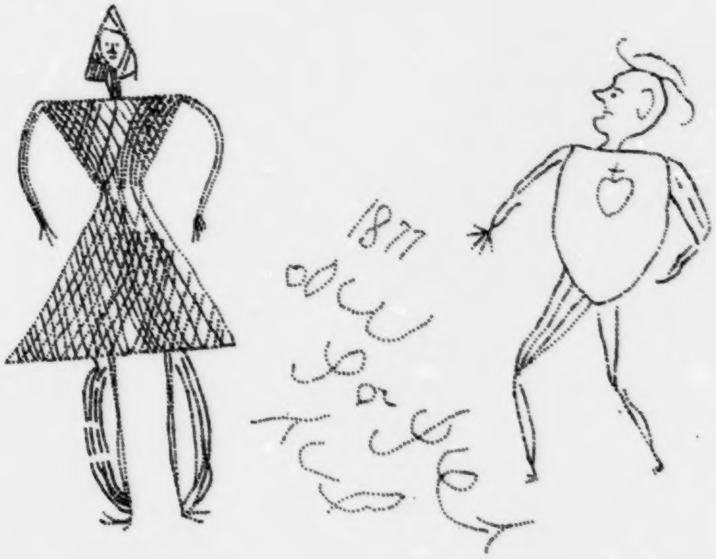

Description:

Our understanding of the prehistory of Nova Scotia is imperfect at best. To date, archaeological research has been limited. A comprehensive study of the province's prehistory, based on its own archaeological resources, has yet to be developed. Studies in adjacent areas of New Brunswick and New England provide the comparative data which must be used to present a most-likely scenario.

Similarities between material found at the Kejimkujik sites and the rest of the province and that found in the New England states suggest that an analogy can be drawn between the areas. Cultural affiliations of the sites in Kejimkujik National Park encompass the Maritime Archaic and Susquehanna traditions of the Late Archaic period as well as Early to Late Woodland period traditions. They represent an occupation time span of roughly 4,000 years, from 2500 B.C. to A.D. 1600.

The chronology presented in Table M-1 provides a general guide to the sequence of prehistoric cultures as well as their approximate ages. It must be remembered that these data represent New England cultures and, while the material evidence suggests close connections, a certain amount of cultural variation and time lag may be expected in the transfer of peoples and/or cultural traits into Nova Scotia.

Table M-1 Prehistoric Cultural Sequence (From New England Sources)

Period	Tradition	Phase	Dates
Palaeo-Indian			8000-6000 B.C.
Early Archaic			6000-5700 B.C.
Middle Archaic			5700-3000 B.C.
Late Archaic	Laurentian		3000-2500 B.C.
	Maritime Archaic (Moorehead; Small Stemmed Point)	Squibnocket	2500-1500 B.C.
(Terminal Archaic)	Susquehanna	Atlantic/Snook Kill	2100-1600 B.C.
		Waterton	1600 B.C.
		Coburn	1200 B.C.
Transitional		Orient	1000 B.C.
Woodland	Early		700 B.C. - A.D.
	Middle		A.D. 200-1100
	Late		A.D. 1100-1600

(Dincauze, 1973; McBride and Dewer. 1981; D. Ritchie, 1980; W. Ritchie, 1969; Snow, 1975.) Underlined traditions and phases are those believed to be found in Kejimkujik National Park.

Culture History Summary

The earliest inhabitants of the Park were people of the Maritime Archaic Tradition who migrated to Nova Scotia sometime after 2500 B.C. Although primarily adapted to harvesting fish and sea mammal resources along the coast, they also relied on land mammals, fish, birds and plant products which could be hunted and gathered inland. We believe that small groups, probably consisting of one or two families, travelled to interior sites in the Kejimkujik area in the fall and winter months, setting up small camps from which they could forage in the surrounding forests. They brought with them traditions of stone technology exemplified by small, stemmed projectile points chipped from quartz and volcanic tuffs, and woodworking tools such as adze blades and gouges of ground and polished stone. These objects, found in archaeological contexts, tell us that the Maritime Archaic people came up the Mersey River to settle along its banks between Loon and George Lake, as well as on the shores of Kejimkujik Lake. Some evidence suggests that they ranged up the Little River to Frozen Ocean, probably on short hunting trips.

The cultural traditions of the Maritime Archaic may continue in the Park to around 700 B.C., evolving gradually, as they did throughout the Maritimes, into the tradition we call Woodland. In the transitional period between these two traditions, around 2100 B.C., a small migration of peoples of the Susquehanna Tradition may have spread into the Park area settling at a winter camp on the lower Mersey River (9B11) and bringing distinctive styles of projectile points. This represents the furthest thrust of a population expansion from the mid-Atlantic states into New England and New Brunswick. The impact of Susquehanna people on the prehistory of Kejimkujik National Park, however, may have been limited. Evidence is limited to five projectile points from one site. The Susquehanna may have co-existed with Maritime Archaic bands for over 1000 years. Alternatively, the few artifacts found on the Mersey River may have been brought into the Park through established trade networks, rather than an actual migration of people.

Around 700 B.C. a technological innovation, ceramics, was introduced to Nova Scotia and brought into the Park. This feature of the archaeological record has been traditionally used to identify the beginning of the Woodland tradition. Ceramics do not appear to have altered the seasonal pattern of campsites, still occupied in the fall and winter by small groups from the coast. At the same time, however, projectile points began to evolve from stemmed forms to notched forms which could be more securely lashed to a spear or arrow shaft.

Woodland occupants of the Park continued to concentrate their campsites along the lower Mersey River and the shores of Kejimkujik Lake. They established camps on the same sites occupied by their probable ancestors, the Maritime Archaic people. Three main camps are known, at Merrymakedge Beach (9B4) and at either end of the rapids below George Lake (9B11 and 9B15). From these sites they made excursions to hunt the mammals of the Park, to gather plant foods and to seek sources of raw materials for their stone tools. The sites on the lower Mersey River were particularly well suited for harvesting the fall run of eels from the lakes to the ocean. Stone weir remains in this area may originate with these prehistoric occupations, but we have no means as yet of dating these structures. At least one was still in active use during the 1950's.

The Park may have experienced an increased population or level of exploitation after A.D. 200. The proliferation of smaller sites around the shores of Kejimkujik Lake and the banks of the Mersey River seems particularly evident in the last 1400 years before contact. Deeply notched agate points of the Middle and Late Woodland Traditions are a diagnostic indication of this spread. At the main base camps, sherds of coarse ceramics associated with these later periods are more abundant than those of the well-made and finely-decorated ceramics of the Early Woodland.

Exploitation of less accessible parts of the Park seems limited. Cultural deposits on the few sites located are small, indicative of short use during foraging activities. Sites on the Little River system contain no evidence of Woodland occupants. Those around Peskawa Lake are as yet unidentified.

Use of the Park seems to decline rapidly after contact with the white man. Definite deposits of 16th to 17th century materials in native contexts are found at only two of the major campsites, and then only in limited quantities. Initial contact with Basque and French fishermen must have occurred shortly after A.D. 1500. A trade pattern soon became established with Micmacs congregating in large groups in the spring at locations on the coast where trade was conducted. Winters were spent inland acquiring furs for trade along with subsistence needs. Eventually the strength of the trade network created a limited dependence among the Micmacs on European goods, particularly weapons, clothing and containers. The furs needed for trade must have been readily available near the coasts since traditional resource utilization camps around Kejimkujik Lake became less frequently employed. Jacques de Meulle, in his trip across Nova Scotia from modern-day Annapolis Royal to Liverpool in the spring of 1686, made no mention of encountering people in the interior (1935:110-113).

Micmacs did not entirely abandon the interior around Kejimkujik, however. Families obtaining land grants around Kejimkujik Lake in the 19th century began farming around the lakes. Early white settlers of the late 18th and 19th centuries benefitted from assistance of Micmacs living in the area. The popularity of the Nova Scotia interior as a recreational hunting and fishing area provided employment for Micmac guides familiar with the lakes and rivers.

At some time in the 18th century, carvings which we see today began to appear on the low slate rock outcrops along the shores of Kejimkujik. Whether the tradition of carving on the rocks extended back into the prehistoric past is difficult to determine. The fragile nature of the carvings makes them susceptible to erosion and many may have disappeared. That they held an important place in historic Micmac culture is evident from the care with which they were drawn and the character of many of the images, including religious scenes of altars and churches, and stylized men and women in traditional dress. Non-Micmac visitors, perhaps using the lakes for recreational purposes, added their images, often in as careful a manner but probably with less concern for meaning. Whatever the relevance of the sites, by the 20th century they appear to have degenerated to convenient canvases for the scratches and initials of passing visitors.

Archaeological Research in Kejimkujik National Park:

The following studies, divided into site surveys and petroglyph research, have been made of archaeological resources in the Park.

Site Surveys

1969 - John Erskine reports to the Nova Scotia Museum two sites at the entrance of the Mersey River to Kejimkujik Lake (9B19). No description accompanies the report, which may refer to petroglyph sites.

1972 - Survey by H. Brad Myers (1973a), Trent University, for Parks Canada, covering the shore and islands of Kejimkujik Lake, and the Eel Weir stretch of the Mersey River below George Lake. Six sites are located (9B1 to 9B6).

1973 - Myers (1973 b,c) completes the survey south along the Mersey River, redefining the Eel Weir sites (9B6 to 9B15) and locating two more on Loon Island (9B16 and 9B17). A survey of the Little River through Big Dam and Frozen Ocean Lakes produces only one site (9B18) on the latter lake. Excavations begun in 1972 at Luxie Cove (9B2) are continued but disrupted by a militant Micmac group.

1975 - Myers (1975) surveys the Peskawa/Peskowesk Lakes system and adjacent portages, locating four sites on Peskawa Lake (9B23) and its portages to Pebbleloggitch Lake (9B20 and 9B21) and to Beaverskin Lake (9B22). Survey of Minard Bay on Kejimkujik Lake locates one site (9B27) at the start of the portage to North Cranberry Lake. Excavations begun at Luxie Cove (9B2) in 1973 are completed.

1979 - John Connolly, Parks Canada archaeologist, tests a proposed parking area at the north end of the Eel Weir (9B15). Results are negative but disturbed material is noted along the existing road.

1980 - Students from the Department of Anthropology, St. Mary's University, salvage artifacts from the disturbed area (9B15) noted by Connolly (Hall, 1981).

1982 - Douglas Ross (1983), Parks Canada archaeologist, re-surveys the Eel Weir sites (9B6 to 9B15) to clarify the area of Zone 1 designation, managing to find all but one (9B8). Excavations are begun on 9B11.

1983 - Robert Ferguson, Parks Canada archaeologist, continues excavations at 9B11.

Twenty-four sites have been listed for the Park as a result of the above surveys. Three additional sites have been identified from isolated finds turned in by visitors to the Park. These include Meadow Beach (9B25) in Jeremy Bay on Kejimkujik Lake and Rogers' Brook (9B26) at its junction with the Mersey River, and a second site (9B24) on Frozen Ocean Lake. None of these locations has subsequently been tested, but it is suspected that they represent only casual use.

Petroglyph Research

Molyneaux (1981) provides a detailed outline of petroglyph research in the Park up to 1980. The major activities to date are as follows:

1887-88 - Visit and recording by George Creed, Postmaster for South Rawdon, Nova Scotia, with visits by Colonel Garrick Mallery of the Smithsonian Institution, Washington.

1893 - Publication by Mallery of Picture Writing of the American Indians, the 10th Annual Report of the Bureau of Ethnology, Smithsonian Institution; includes six pages on the Kejimkujik petroglyphs.

1945-46 - Dr. Arthur and Mrs. Olive Kelsall photograph and cast petroglyphs.

1970 - James White (1971), Trent University, surveys and maps sites for Parks Canada.

1971-74 - H. Brad Myers (1972; 1973d), Trent University, records Fairy Bay 2 and 3 sites for Parks Canada.

1973 - Marion Robertson, Nova Scotia Museum, publishes redrawn copies of Creed's tracings in Rock Drawings of the Micmac Indians.

1976 - Myers begins moulding of Fairy Bay petroglyphs. Project is not completed.
- Myers submits manuscript for "The Petroglyphs of Kejimkujik National Park: A Comprehensive Report".

1981 - Brian Molyneaux (1982a), Royal Ontario Museum, records petroglyph sites at Mill Bay, Peter Point and George Lake for Parks Canada.

1983 - Molyneaux (1984a) records Fairy Bay 1 and 3.

1984 - Molyneaux (1984b) submits manuscript for "An Analysis and Interpretation of the Micmac Petroglyphs of Kejimkujik National Park".

The Creed records of 1887-88 are direct intaglio impressions of all known petroglyphs in Kejimkujik National Park and at a nearby site presently under McGowan Lake. Copies of the tracings are on file in the Nova Scotia Museum, the Public Archives of Nova Scotia and the Smithsonian Institution in Washington. They provide a record of the glyphs prior to the last 100 years of erosion and defacement. Photographic copies of the Smithsonian tracings are on file in the Historical Resources Research section, A.R.O., P.C. (Molyneaux, 1982b).

Myers' records include both drawings and photographs. The drawings are all hand drawn to scale and thus are subject to inaccuracy. The photographs of grid squares are taken at an angle, introducing an element of distortion. Moulds of a selection of petroglyphs provide excellent casts. The work, unfortunately, produced permanent red stains on the rock surface. Myers' records and reports for Fairy Bay 2 are now in the H.R.R. section of A.R.O., P.C. Documentation on Fairy Bay 3 has not been received.

The recording by Molyneaux has produced both accurate direct tracings and professional quality photographs taken perpendicular to the rock surface which almost eliminates distortion. These records are complete for Mill Bay, Peter Point, George Lake and Fairy Bay 1 and 3. They are stored in the H.R.R. section of A.R.O., P.C.

Most of the petroglyph sites in the Park have now been recorded. A definitive recording of Fairy Bay 2, however, has not been done. This is the largest concentration on a single rock face as well as one of the most endangered, and must be documented as soon as possible to complete the records.

Evaluation:

Resource Management Objectives

1. To provide the highest degree of protection for the archaeological resources of Kejimkujik National Park while providing compatible opportunities for research, visitor understanding and appreciation.

Site Analysis:

Individual sites recorded in Kejimkujik National Park are listed in Table M-2. They range from isolated beach finds to multi-component campsites; from Late Archaic occupations ca. 4000 years ago to recent historic Micmac activities. Twenty-eight archaeological sites have been listed. Of these, twenty-two have definite prehistoric and/or early contact components, three have questionable evidence, one was reported but not identified and one is of recent origin. One has been deleted. Four petroglyph sites are also listed.

This report does not attempt to deal with historic resources in the Park relating to the Euro-Americal occupation of the area, except where these have been recorded in the early surveys or where they overlap with prehistoric occupations. Petroglyph sites, although of historic date, are included because of their unique record of the Micmac descendants of the prehistoric inhabitants of Kejimkujik National Park.

Archaeological sites are found on three major water systems in the Park. These water systems are the transportation routes which brought prehistoric and early historic peoples into the Park. The primary river system, the Mersey, can be subdivided into KEJIMKUJIK LAKE and the MERSEY RIVER, the latter being that portion of the river south of Kejimkujik Lake. Other sites are found on the LITTLE RIVER system and the PESKAWA/ PESKOWESK LAKES. Petroglyph sites represent a special cultural resource with special resource management requirements. These are all found along the Mersey River and Kejimkujik Lake.

Kejimkujik Lake
9B1
2
3
4
5
19
25
26
27

Mersey River
9B6
7
8
9
10
11
12
13
14
15
16
17

Little River
9B18
2B

Peskawa/Peskowesk Lakes
9B20
21
22
23

Petroglyph Sites
Fairy Bay
Mill Bay
Peter Point
George Lake

In Table M-2, the sites are presented in consecutive order by their Parks archaeological site number. The first part of this number, 9B, identifies each site as a part of the Kejimkujik National Park inventory. The second part is a number assigned as each site is reported. A list of petroglyph sites follows.

The Borden designation for each site is also given. This is the standard form of registering sites in Canada and is based on a regular grid system placed over the country (Borden, 1952). Upper and lower case letters designate the grid square in which the site occurs. The following number is assigned consecutively as sites are reported within each square.

Description and analysis of most of the sites are dependent on reports and field records from the Myers survey. The information is not always clear or complete. An evaluation has been made on the basis of those documents and artifacts which have been returned to Parks Canada by Myers.

Archaeological Site Significance:

Referring to Table M-2, a Classification of Significance, based on resource management issues, has been used to rank each site into one of four levels, A to D. This assessment must be recognized as tentative since it is difficult to evaluate sites on the basis of limited testing or surface finds. It is sufficient, however, to provide a guide for resource management planning.

It is also important to realize that each site contains unique information to some degree. Even the lowest classification must, therefore, receive appropriate EARP screening and mitigation prior to development.

Classifications are judged as follows:

A - Sites requiring immediate salvage, stabilization and/or protection. These are sites experiencing destruction through erosion, vandalism or public use. (e.g. Fairy Bay 2 petroglyph site: petroglyphs suffering from erosion, vandalism and wear through public visitation, and requiring proper recording.)

B - Sites with significant known deposits or features representing habitation sites, multi-component occupations, specialized activity areas and/or unique features or cultural representation. These sites should be regularly monitored for natural or human disturbance. They also require adequate scheduling for excavation, recording or protection with regard to development plans. EARP screening and appropriate mitigation are critical for these sites. (e.g. Merrymakedge, 9B4: multi-component campsite in an area of concentrated day use.)

C - Sites of limited use with small deposits relating to single or casual use, or which are largely disturbed. These sites offer limited potential for research although they may be areas of specialized activity. They should be readily salvageable with little impact on development plans. EARP screening is required for these resources but mitigation measures should be

Table M - 2 Summary of Archaeological Resources in Kejimkujik National Park

MA - Maritime Archaic; S - Susquehanna; W - Woodland (E - Early; M - Middle; L - Late); C - Contact; ? - unknown affiliation

PC # (9B)	Borden #	Site Name	Cultural Affiliation(s)	Class of Significance
1	BcDh 2	Little River	MA	D
2	BcDh 3	Luxie Cove	E-LW; C?	B
3	BcDh 4	Pine Tree	LW	B
4	BcDh 5	Merrymakedge	MA;E-LW;C	B
5	BcDh 6	White Beach	M-LW	C
6	BbDh 13	Eel Weir I	M-LW	C
7	BbDh 2	Eel Weir II	M-LW	C
8	BbDh 3	Eel Weir III	recent	D
9	BbDh 4	Eel Weir IV	M-LW	C
10	BbDh 5	Eel Weir V	MA?;W;C?	C
11	BbDh 6	Eel Weir VI	MA;S;E-LW;C	B
12	BbDh 7	Eel Weir VII	E-LW	B
13	BbDh 8	Eel Weir VII	M-LW	C
14	BbDh 9	Eel Weir IX	E-LW	B
15	BcDh 7	Eel Weir X	MA;E-LW	B
16	BbDh 11	Loon Island I	MA;M-LW	C
17	BbDh 12	Loon Island II	?	C
18	BcDi 1	Frozen Ocean Lake I	MA	C

Table M-2 (cont.) Summary of Archaeological Resources in Kejimkujik National Park

PC # (9B)	Borden #	Site Name	Cultural Affiliation(s)	Class of Significance
19	----	Fairy Bay?	--	--
20	BbDi 1	Pebbleloggitch Lake	?	C
21	BbDi 2	Pebbleloggitch Portage	?	C
22	BbDi 3	Peskawa Portage	not a site?	D
23	BbDi 4	Peskawa Lake	not a site?	D
24	BcDi 2	Frozen Ocean Lake II	MA	D
25	BcDh 8	Meadow Beach	?	D
26	BcDh 9	Rogers' Brook	?	D
27	BcDh 10	Minard Bay	?	D
Fairy Bay Petroglyphs			18-20th C	A
Mill Bay Petroglyphs			18-20th C	A
Peter Point Petroglyphs			18-20th C	A
George Lake Petroglyphs			18-20th C	A
28	BcDi 3	Frozen Ocean Lake III	?	D

relatively minor (e.g. sites along the Eel Weir, 9B6, 9B7, and 9B9: isolated small deposits between major campsites, with little danger of disturbance or erosion.)

D - Sites identified by isolated surface finds or which may have been identified by artifacts of possible but uncertain human manufacture. One site, identified solely by recent "historic" material, is also included. Related cultural deposits may be anticipated at these locations.

Research Summary:

The pattern of site locations in Kejimkujik National Park indicates that the river system of greatest significance was the Mersey. Twenty of the 24 verifiable prehistoric sites in the Park occur along this river and the shores of Kejimkujik Lake through which it runs. The greatest concentration of sites is along the Eel Weir section between George and Loon Lakes, where two seasonal habitation or base camps and seven specialized activity areas are located. A second concentration occurs at the north end of Kejimkujik Lake, with a base camp at Merrymakedge and at least two smaller resource utilization camps on Indian Point.

Evidence of activity along the Little River system is limited to a small deposit of flakes and two isolated projectile points from Frozen Ocean Lake. The Peskawa/Peskowesk area contains four recorded sites, of which one is verifiable on the basis of material on hand, one is identified by artifact descriptions in field notes, and two contain quartz materials of questionable merit.

Survey results also indicate patterns of Park use through time. Again the primary significance of the Mersey River system is indicated by evidence of occupation from Maritime Archaic to Late Woodland and historic contact. Occupation seems to have been continuous over this 4000 year time span, particularly at 9B11, the largest of the habitation sites. Proportions of diagnostic artifacts, however, indicate increased activity in the Middle to Late Woodland. Whether this indicates population increases, shifting land use patterns or simply a proliferation of the ceramic wares which most readily identify these traditions is difficult to determine as yet.

The two diagnostic artifacts from Frozen Ocean Lake suggest that the area was used, perhaps by small foraging parties, at least during the Maritime Archaic. Cultural affiliations of the Peskawa/Peskowesk Lake sites cannot be determined from the artifacts recovered, but the low site count and artifact yield again suggest sparse use by foraging parties.

The four petroglyph sites are all places along the Mersey River, three on Kejimkujik Lake and one on George Lake near the Eel Weir sites. No direct connection can be made with prehistoric traditional practices in the Park. Nonetheless, they contain significant images of 18th and 19th century Micmac religious beliefs and material culture, as well as a record of names and dates, suggesting that they played an important role in Micmac culture in late historic times. This could stem from an earlier tradition lost to us by the erosion of the rock surfaces.

Images from Euro-American inhabitants and visitors are of less importance as a historical record from which cultures can be examined. They do, however, provide a record of individuals of non-Micmac origin who have used the Park area in its early historical days.

Resource Management Concerns:

1. Protection of the Kejimkujik petroglyph sites from vandalism and erosion is a primary concern for cultural resource management. These sites are all classified as "A" in the scale of significance because of the immediate threat of destruction which they face.

2. Prehistoric sites must be protected from erosion, human disturbance and development. Both erosion and human disturbance are minor problems. Almost all sites in the Park are relatively undisturbed by on-going natural and human activities in the Park. Monitoring of areas with heavy use, such as Merrymakedge Beach, may help to ensure that sites remain undisturbed. In general, the sites have not been targets of looters. Protection of sites from development, or appropriate mitigation prior to development, is the greatest concern.

   Protection of archaeological resources is critical for a number of reasons. Foremost of these is that they are a non-renewable resource: once disturbed or destroyed, a site can never be recreated. Also, although several sites may have served a similar function, the archaeological record of prehistoric cultures is subtle and each site offers potentially unique information for interpreting the past. Finally, archaeology, like any research discipline, is constantly improving its techniques. Since excavation is a destructive form of research, it is essential that sites, or parts thereof, be preserved for more advanced studies in the future.

3. Most of the material excavated by H. Brad Myers in the 1970's has been recovered, as have many of the field notes. While we have a poor record from Myers of what documents and artifacts exist, it is apparent that some of the material is still missing. This includes all photographic records of the archaeological work, any field notes that Myers may have made himself, and certain artifacts reported in manuscripts or in the field notes of his crews, but not returned with the bulk of the material in 1984. A manuscript report plus drawings and photographs of the petroglyphs at Fairy Bay 3d are missing. However, this work has been redone with greater accuracy by Molyneaux (1984a).

Research Requirements:

1. Fairy Bay 2 petroglyphs should be recorded in the same manner as other petroglyph sites in the Park. At present, we have no accurate copies of the glyphs in either direct tracings or photographs. It is critical to complete this work before further erosion and defacement occurs.

2. If interpretive programmes require more detailed input regarding human prehistory of the Park, archaeological materials returned by Myers should be analyzed to clarify culture history of each site and of the Park.

The material at present is poorly provenienced and reported on. Major work is required to sort the material, cross-check with all the field records and catalogue it. Several of the sites identified by Myers, but of questionable validity, should be re-examined. Also, sites identified by isolated surface finds should be tested for associated cultural deposits.

Recommendations for Management:

1. A Petroglyph Resource Management Plan should be prepared and approved to ensure appropriate protection of these unique archaeological features.

2. The recording of petroglyphs at Fairy Bay 2 must be completed, by direct tracings and professional overhead photography, in a manner compatible with previous recording by Brian Molyneaux (1982a; 1984a). Moulds should also be made of all rock surfaces to provide a permanent physical record.

3. Consultation with staff having expertise in archaeological research is required in any EARP conducted within the Park, whether or not sites have previously been identified in the particular area. Previous archaeological surveys cannot be depended upon to have located all sites, only to give an indication of likely distribution. Park development probably presents the greatest threat to archaeological resources.

4. While most of the artifacts and many of the records from the archaeological surveys of H. Brad Myers have been recovered, some of these items are still in his possession. Continued efforts must be made by Historical Resources Research, A.R.O., to recover these items.

Opportunities:

The petroglyphs at Kejimkujik provide a visible resource to enhance the visitor experience in Kejimkujik National Park. Problems of vandalism and site protection, however, must be solved before they can be adequately utilized for this purpose. As a research resource, the petroglyphs provide insight into 18th and 19th century Micmac culture in the Kejimkujik area. Religious beliefs, ceremonialism, individuals and genealogies, dates and material culture are all recorded on the rocks.

The archaeological sites provide an opportunity to increase our understanding of the prehistoric culture history of Nova Scotia. Important questions of seasonal resource utilization patterns can be studied. Materials from archaeological sites can be used to interpret the prehistory of the area to the public.

Limitations:

Use of the petroglyphs as an interpretive feature in the Park continually exposes them to the threat of vandalism. Appropriate and perhaps costly measures are required to provide adequate protection. Such measures may have an impact on the wilderness setting.

An awareness of prehistoric site locations within the Park may expose these sites to looting activities which have not been a threat in the past. Many of the sites are in remote areas which cannot easily be monitored on a regular basis. Interpretation of the sites must avoid explicit information on the location of sites that cannot be adequately protected.

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PAST LAND USE

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Description:

Visitors to Kejimkujik often regard the forested lands of the Park as pure, untouched wilderness. In fact, there is probably not more than a few hectares that have not been changed from their "virgin" state by fires or logging.

Historical References

> March 2, 1784 . . . A Gentleman arrived yesterday at the Falls from Annapolis and this day came to Town. His Name is Heck, has been a Captain in Some of the New Cores. He reports that he has been Seven days on this Rout; that he judges the distance to be one hundred Miles; that it runs thro three Large Lakes and a Number of Small Lakes. The Country is very Rockey and has been burnt in General; that he finds but a very little good land, only in small parcels . . .
>
> from the Diary of Simeon
> Perkins, 1780-1789
>
> Liverpool, Queens County

In 1801, the Lieutenant-Governor of Nova Scotia commissioned Titus Smith, a young botanist, to undertake a survey of the mainland of Nova Scotia. Smith's detailed reports give us a good idea of what the forests looked like during that time. It is in many ways an astonishing document, since at the time of his travels, there were no maps, precious few roads, and even fewer people in central southwestern Nova Scotia.

> August 11, 1801. Continued course for 1-1/2 miles on stoney white birch land and struck Liverpool Road 22 miles from Liverpool, followed road 3 miles N. to Mr. Burk's at Port Medway River. Timber a

> young growth of white and yellow birch, beech, soft and hard maple, ash and hornbeam very tall. Informed by Mr. Burk this kind of land continues 8 miles northward along the road when it grows barren till within 16 miles of Nictau . . .
>
> from A Natural Resources Survey
> of Nova Scotia, 1801-02 by
> Titus Smith Jr.

In 1912, Fernow mapped the forest resources of this area of the province (see Fig. N-). He describes the fire barrens on the granite plateaus as follows:

> The soil as a whole is rather thin and very peaty, the turf often caking in dry weather. The moist depressions are filled with alternating groups of pure stands and mixed stands of fir, black spruce, red maple and paper birch. Interspersed with these are sandy knolls on which white pine originally grew before being killed out by repeated fires.

Before the Europeans came to settle in Nova Scotia there were probably periodically natural fires, and the Micmacs may have used fire as a "management" technique for increasing moose browse. With the coming of the Europeans there is every reason to believe that fires increased, however. The early settlers used fire as a way of clearing the massive stands of trees which interfered with planting crops. As long as these fires did not threaten homes and other buildings they were left to burn. In addition, "carelessness" on the part of lumbermen, or hunters, was probably also to blame for the numerous fires.

Most accounts agree that the entire area has been burnt over at least once. The severity of the fire depended on many factors; the type of forest cover, conditions of drought at the time, and understory development, to mention a few.

Regeneration after fires was also dependent on many factors, not the least of which was the type of bedrock, surficial material, and soils that each region contains. In general, it can be stated that regeneration on the slatey soils was much quicker and more lush than on the granites or quartzites.

Agriculture:

Though nearly half of the land in the Park was originally granted to farmers, very little cultivation was undertaken except for the brief Indian settlement, and a few farms on the extreme eastern edge of the Park boundary. The only good soils for farming occurred on the tops of the drumlins, where the interaction of slatey soils and hardwood trees had produced a fine, sandy loam. The evidence to date suggests that there were farm lots only at the following locations:

Farmlands Trail:	Rogers family
Tom Canning Field:	In the area around the present Look-off at Fairy Bay
Canning Field:	On the New Grafton Road
Head of Grafton Lake:	Two farms?

Fernow's map of 1912, although general, is invaluable in indicating areas which were under cultivation at that time.

Morrison's account (1977; Oral History of Northern Queens and South Annapolis Counties) provides an excellent account of the vagaries of economics and farming in the area.

Meadow Hay

As mentioned previously, most of the land around the "Fairy" Lake was granted to farmers . . . but most of it was unsuitable for agriculture and was never used as such. However, the occurrance of tall marsh grasses in some areas was a very important factor for these early settlers, and for those who followed. It was much easier for the farmers to cut the wild "meadow" hay, stack and dry it, and then return in the winter to supplement the winter food supply for the oxen. Historic photographs record how this was done. During the summer when the grasses were at their best, farmers would load their oxen onto rafts, and head out for their own patch of meadow hay by water (in some cases, the meadow hay could be reached by land). The hay was cut and stacked to dry. In the winter, the oxen would haul their wagons back to the meadow where the hay was collected.

The extent of this practice within the Park is not clearly documented. It is known that the area around Jakes Landing was used, as was the area around the lakeshores at Heber Meadow.

> The brook was mostly known as Roger's Brook, after Joed and Willie Rogers. Thomas Kempton had the 100 A lot at the mouth, and hayed the two meadows just above the Park highway. Thus, at the mouth, it was often called Tommy's Meadow Brook.
>
> Notes from discussion with Walter
> Sheffer and Joe Rogers, 1971,
> E. Mullen.

The impact of harvesting the wild hay on the successional development of these areas is uncertain. At Heber Meadow, it may have had the effect of arresting the intrusion of heath shrubs, by removing organic material and thus preventing the build-up of peaty soils preferred by these shrubs (authors' personal observation).

Lumbering:

Initially the British had been attracted to the area by the abundance of masting timber, and White Pines of more than 24 inches in diameter were marked with the "broad arrow", consigning their use to His Majesty. There are suggestions that some of the petroglyphs found at Fairy Bay depicting sailing vessels were carved there by early "timber cruisers" of His Majesty's Navy. The arrival of the colonists in the 1760's created a market for building materials along the coast. After this, export of timber became an important economic commodity, and in 1766 Simeon Perkins filled orders for England, Bermuda, Newfoundland, and the West Indies.

It is uncertain when logging began in the Park area but almost all of the land has been cut over at some time. Thomas Raddall (1968) estimates 1840 to 1870 as the period of most intense cutting. (Resource Atlas, 1976.) The remains of several sawmills indicate some local use of the product but most of the lumber, even the quantities taken from the Annapolis County side of the line, was driven down through the lakes and rivers to Liverpool.

> The first time we drove we had to use dynamite at Rocky Falls, and the water left us before we got down. These two drives were from Frozen Ocean. It's been a long time since anybody drove from above that. Timber was driven out of Innes Brook, Stewart Brook, and all that country, a long time ago.
>
> From an interview with Chester Fancy, at his home in Maitland Bridge, 1980, E. Mullen.

In order to drive logs across Kejimkujik Lake, booms were made, and winched along from one anchor to another by men on a raft.

> The Lantern Rock stands to the south of Keji Lake and a lantern was attached here to guide the log drivers. There was no other place where this happened. A day and a night would be enough to get the logs across the lake. The log drives usually came through between Little Muise and Big Muise Island.
>
> From an interview with Fred Lewis, aged 65, 1977.

In this century the Mersey Paper Company acquired land originally granted to the Nova Scotia Central Railway as well as much private land. With the advent of portable sawmills, these larger concerns were able to move inland. Many roads were bulldozed to get at the available wood.

When the area was proclaimed as a National Park, cutting of wood ceased. There is, however, a very long and rich history associated with lumbering in the area, and to date there has been no concentrated effort at reconstructing this history.

Gold Mining:

Gold was discovered near Brookfield in 1885 in a vein that ran through the ledges of an old pasture. Gold fever swept the Northern part of Queens County, and created a short-lived "boom" in development of the area.

Within the Park there were three gold mines (see Fig. N-). Cumming (1979) and Morrison (1977) give detailed accounts of the exploration for gold, and its impact on the community. Although the workings within the Park yielded very little ore to their hard working owners, they did yield a variety of "tall tales", and brought the area new attention. Kejimkujik's most famous character, Jim Charles, was immortalized in a story by Thomas Raddall, called "Lost Gold at Kejimkujik".

The remains of shafts, iron boilers, and cabins can still be found among the trees which are reclaiming the area around McGinty Lake.

The Resort Era:

Early accounts of the Kejimkujik area paint a very unflattering picture. To the early settlers, it appeared to be desolate wilderness, where the thin soils, rocks, and bogs would support nothing useful.

> Bleak, unsightly, unproductive, mangled and distorted out of all shape and form of loveliness yet with a fierce, wild fascination in it that amounts almost to beauty.
>
> A. Paine, The Tent Dwellers,
> 1908.

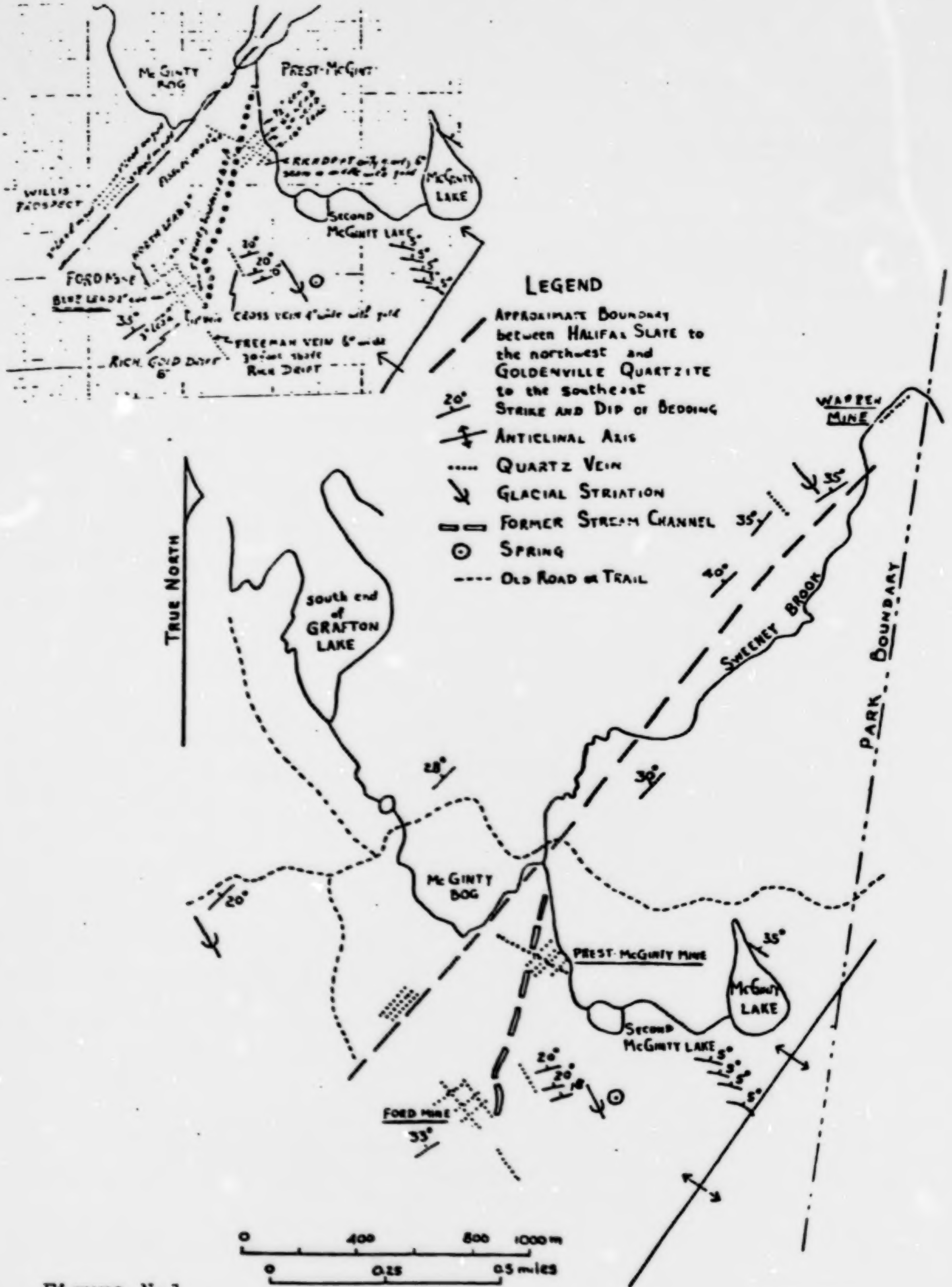
McGinty Bog
Prest-McGinty
Willis Prospect
Ford Mine
Best Lead
Second McGinty Lake
McGinty Lake
Cross vein 4" wide with gold
Freeman vein 6" wide
Rich Drift
Rich Gold Drift 6"
LEGEND
Approximate Boundary between Halifax Slate to the northwest and Goldenville Quartzite to the southeast
Strike and Dip of Bedding
Anticlinal Axis
Quartz Vein
Glacial Striation
Former Stream Channel
Spring
Old Road or Trail
True North
south end of Grafton Lake
Warren Mine
Sweeney Brook
Park Boundary
McGinty Bog
Prest-McGinty Mine
McGinty Lake
Second McGinty Lake
Ford Mine
20°
28°
30°
35°
40°
33°
5°
18°
0
400
800
1000m
0
0.25
0.5 miles

Figure N-1

Sketch map to show the location of three former gold mines within the park:- the Ford, Prest-McGinty and Warren Mines. These are all on the same northeast trend of a zone of interbedded quartzite and slate which occurs near the top (or upper boundary) of the Goldenville Formation.

Yet, it was this "unproductive" nature of the landscape that allowed it to become a haven for those who sought the wilderness, either for fishing, hunting, or simply to get away. During the latter part of the 1800's, many people had already come to the area, usually from the eastern part of the United States. The early tourists were also usually wealthy, since travel to the area was a costly and time-consuming affair. Gradually, as train service, and then road access improved, more and more people came.

Ked-ge Makooge Lodge was built in 1909, under the direction of Clarence "Will" Mills, from Annapolis Royal. The lodge was built on Jim Charles Point, just above the site of Jim Charles Cabin (Morrison, 1977). Cabins were also constructed around the point.

About 1919, the first cabin was built at Jake's Landing by Fred Rogers. Later, his son Joe Rogers constructed more cabins at what is now the location of the Interpreters' Field Office. This was also the site of the annual Nova Scotia Guides' Meet, from 1952 to 1961 (interview with Joe Rogers, Park files).

Smith Baxter built three cabins for guests on Indian Point (1918-1919), and Mert Minard built the first of a number of cabins at Merrymakedge. (Guiding in Kejimkujik, Mullen, 1980.)

Many local men were hired as guides for these visitors, and the history of guiding is full of tales, some true and others not. The guides themselves often had rough camps, which they used for trapping during the "off" seasons. Later, as individual fortunes improved many local people built summer cabins in the area as well.

Mr. Norman Phinney, who ran Kedge Lodge from 1946 until 1957, recalls that the Kedge philosophy was consistent from the beginning and there was no hard sell, no logging, or no roadbuilding ("spoilers"). Environmental damage was no problem in Mr. Phinney's view:

> All our activities were on the water . . . they were there to enjoy the area, catch the fish, and they would make darned sure the cigarettes were out and they were an entirely different class of people than people just going in to demolish a place, or going in shooting deer or something.

It would appear that the "Resort" era at Kejimkujik did not impact a great deal on the landscape.

The Resource-Based Economy:

The early settlers to Eastern Canada were almost completely dependent on the natural resources of the area. Their herculean efforts at coping with the new world have been documented many times. However, in many areas, the early marks of resource use have been nearly eradicated over the last two hundred-odd years. However, at Kejimkujik, settlement has been relatively recent because it was inland, away from the first developments along the coast. For this reason, there are many remains of the settlers' struggles to win a home over the wilderness.

> Dell Thomas* had a cabin where Eugene Merry's cabin was at the mouth of the Mersey River. I built the road out there that went out to it from Jake's Landing . . . Used to be charcoal pits on the road going out to where Thomas' cabin was. They used to make charcoal for the blacksmiths there.

From an interview with Joe Rogers,
New Grafton, February 1980,
E. Mullen

*Dell Thomas was one of the guides immortalized in A. Paine's book, of 1980, The Tent Dwellers.

Again from Joe Rogers, during this same interview:

> People* from West Caledonia let their cattle run there across the Eel Weir for the summer. One bear killed about seven cattle through the summer at Loon Lake.
>
> Tenting at the Eel Weir was very common. Forty years ago there were big clearings there. You could put up half a dozen tents.
>
> *During the early 1920's.

Throughout the history of the area, the natural resources found in the Kejimkujik area provided. If crops failed, or there was no market, then the men turned to lumbering, hunting or guiding to make a living.

Evaluation:

Unique, Critical, and Representative Areas

Unique features within the Park would include the Eel Weir at the outflow of Kejimkujik Lake (as a traditional camping area), Fairy Bay (for the petroglyphs, and the history of the European activities there), the gold mining area, and Jim Charles Point.

Depending on the mandate of future Park management concerns, certain areas could be established as "representative" for each period of land use within the Park. For example, the areas around the Prest-McGinty Mines could be cleared and maintained as representative of the gold mining era in the region. Farm clearings could be maintained as representative areas; however, since farming within the Park area was a relatively minor feature, there arises the question of how "representative" this would be. Of far more importance to the people of the area was the "Resort" era (Morrison, 1977). At present it is not a part of Parks policy to maintain buildings or clearings where cabins have stood. Perhaps the representation of this part of the Park's history should be dealt with by the Interpretive Service.

Monitoring Requirements:

Old farm clearings and other openings are at present allowed and even encouraged to grow up, and be taken over by native forest species. The removal of the "old field" habitat may have a local effect on bird and mammal species which require these open areas. Monitoring of such species as Deer, Ruffed Grouse, and Fox would indicate the degree to which these species are affected by succession, and at that time management would be able to make a decision with regard to maintaining clearings and edges. The successional development occurring in these openings is a definite "removal" of another kind of habitat within the Park, and management in future will have to decide how to deal with this within the framework of Park's Canada's mandate.

Recommendations for Additional Study:

There is no clear and organized report of past logging efforts within the Park. It is suggested that research into specific logging practices in each area of the Park be undertaken. This research would also indicate areas where fire may have occurred as well, and give management and others a more clear picture of how succession occurs, and how fast. This in turn will give future management an idea of how forests could be managed within the Park, in the event that this became necessary.

Resource Management Concerns:

The chief concern lies with the decision to maintain old fields or other clearings, with regard to species management, or interpretation of past land use.

Opportunities:

Interpretation

Interpretation has a major role to play with regard to past land use and the public. Firstly, past land use has to do with people, and the public is always interested in what "people" have done over the years. Thus, this is a very effective way of getting Park users interested in many facets of the National Park. Secondly, in Atlantic Canada, where most Park visitors originate, the landscape of today is almost completely caused by the past land use that occurred. This is an extremely important message for Park visitors to receive since National Parks play a major role in allowing "nature to take its course", whereas a great majority of the land outside the National Park is intensively managed for agriculture or forestry.

Scientific Study

The major opportunity in this area would be the study of regeneration after fire, successional development in old fields or clear cuts, and, of course, an ongoing collection of oral information or written records concerning past land use.

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Present Land Use:

Description:

Visitor Use and Enjoyment

The Kejimkujik National Park Management Plan for visitor use and enjoyment states:

> "To provide a diversity of outdoor recreation opportunities compatible with the character of the Park, and to encourage visitors of varying interests and skills to experience and enjoy the Park."
>
> (Kejimkujik National Park Management Plan, 1979)

Four sub-objectives for visitor services include:

"1. To ensure the essential needs of visitors are met in order to enable them to enjoy the Park.
2. To encourage visitors of varying interests and skills to enjoy the Park.
3. To encourage visitation to the Park in all four seasons.
4. To maximize the opportunities for appreciation of the scenery along the existing Parkway."

(Kejimkujik National Park Management Plan, 1979)

Themes for Recreation:

Ten themes appropriate for recreational activities at Kejimkujik National Park have been identified from the Park's Management Plan:

1. Mixed forests
2. Typical wildlife
3. Lifestyles and legends of the Micmac Indians
4. European occupation
5. Quiet natural environment

6. Inland character
7. Abundance of fresh water
8. Aquatic fauna
9. Abundance of reptiles and amphibians
10. Glacial history

(Visitor Activity Management Planning Process, 1982)

Recreation Activities, Visitor Use, Visitor Facilities:

Recreation Activities:

Kejimkujik National Park provides outstanding natural and cultural resources for visitors to appreciate and enjoy thirty-seven visitor activities (Table 0-1). During the Summer the visitors can be grouped into five major activity segments:

1. Semi-serviced campers
2. Group campers
3. Sightseers
4. Day-use recreationalists
5. Primitive campers

In the Fall, camping, sightseeing, hiking, and backcountry camping are popular. In the Winter, visitors come to participate in cross-country skiing, picnicking, snowshoeing, sightseeing and camping. Backcountry camping, fishing, picnicking and sightseeing activities predominate in Spring. The Park has become a four-season outdoor recreational area for primarily Nova Scotians (Table 0-2). During the Summer and Fall seasons the percentage of American visitation increases (Table 0-3).

Table 0-1 Recreation Activities in Kejimkujik National Park

Activity	Appropriate	Occurring	Encouraged or Promoted by Park
Demonstrations	*	*	*
Wildlife/Birdwatching	*	*	*
Theatre Attendance	*	*	*
Walking	*	*	*
Exhibit Viewing	*	*	*
Canoeing	*	*	*
Relaxing	*	*	*
Camping, Semi-serviced	*	*	*
Picnicking	*	*	*
Tubing/River Floating	*	*	
Crafts	*	*	
Kayaking	*	*	
Painting	*	*	
Swimming, Non-supervised	*	*	*
Visiting Friends	*	*	*
Scientific Study	*	*	*
Hiking	*	*	*

Table 0-1 (cont.) Recreation Activities in Kejimkujik National Park

Activity	Appropriate	Occurring	Encouraged or Promoted by Park
Automobile Sightseeing	*	*	*
Swimming, Supervised	*	*	*
Camping, Primitive	*	*	*
Sailing	*	*	
Wind Surfing	*	*	
Bicycling	*	*	*
Fishing	*	*	*
Orienteering	*	*	
Rowing	*	*	*
Camping, Serviced	*		
Hostelling	*		
Scuba/Skin Diving	*	*	
Horse Riding	*	*	
Power Boating	*	*	*
Camping, Group	*	*	*
A.T.V./Mini-bike Riding			
Playground Use	*	*	*
Non-mandate Sports	*	*	*

Source: From Wildlands Associates, 1983.

Table 0-2 Summer Season Activity Segments (Reporting Visitation in All 4 Seasons)

Season(s) have visited Kejimkujik	Total	Main Park Campers	Picnickers	Back-country Campers	Day Canoers/ Hikers
	%	%	%	%	%
Summer	72	75	63	77	70
Fall	29	27	29	35	29
Winter	10	6	10	19	14
Spring	20	19	18	24	23

(Analysis of 2 data sets, Market Facts, 1984.)

Table 0-3 Summer Season Activity Segments

Residence	Total	Main Park Campers	Picnickers	Back-country Campers	Day Canoers/ Hikers
	%	%	%	%	%
Nova Scotia	75	83	63	69	61
Other Atl. Prov.	3	4	3	5	4
Quebec/Ontario	5	4	7	5	9
Prairies/B.C.	1	1	3	2	2
New England	13	6	20	18	26
Other U.S.	2	2	3	1	-
Other	1	*	2	2	-

(by Origin. Market Facts, 1984

Visitor Use

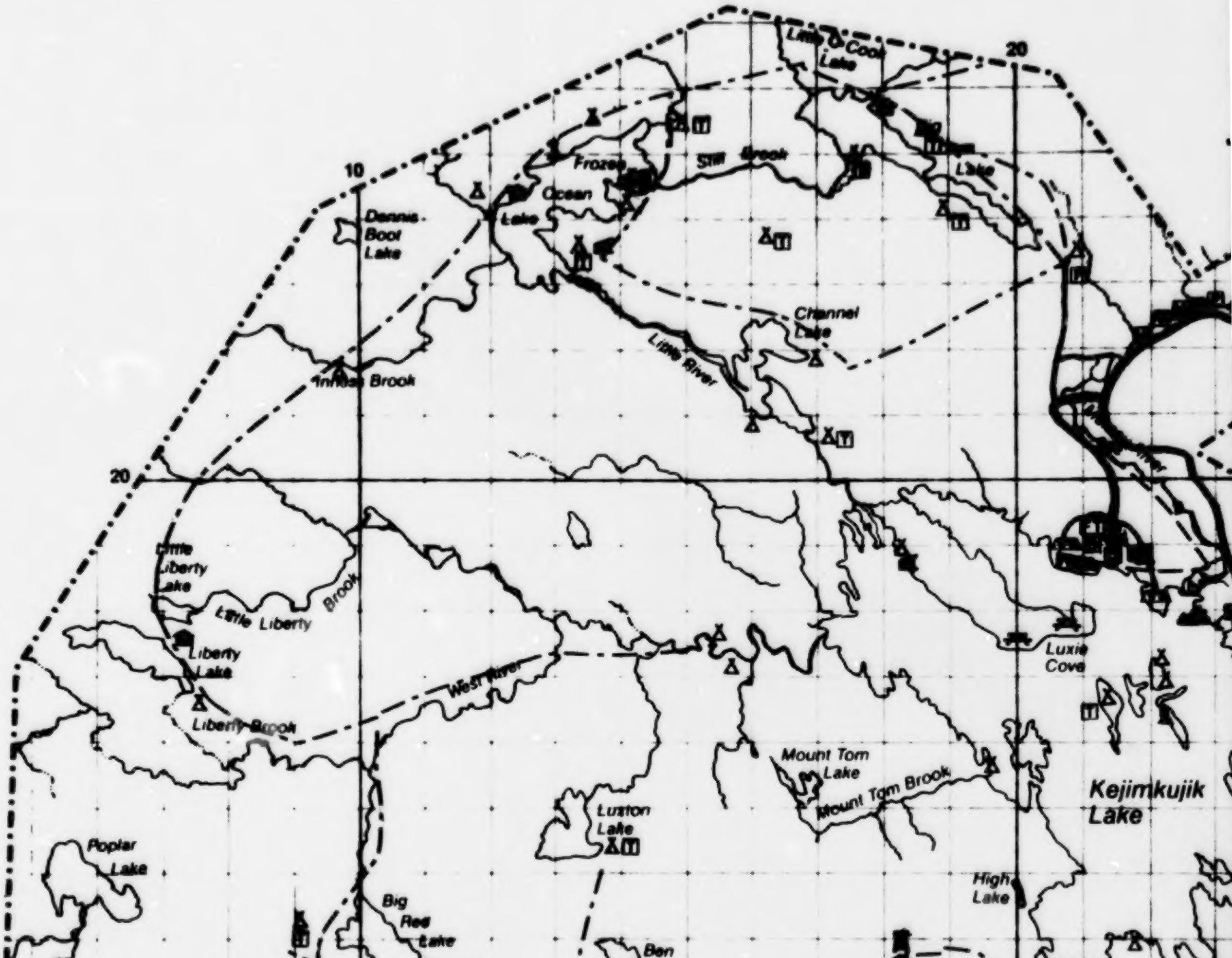
The Park receives approximately 200,000 visitors annually. Sixty percent of this visitation occurs during June, July and August. The other 90,000 visitors come to the Park throughout the remaining nine months. (Figure O-2.)

The average length of stay, average number in party and skill level and party composition differs for each visitor activity segment (Table O-4).

Visitor Facilities

Visitor facilities required for provision of recreation activities are located throughout the Park. A discussion of these follows; however, more detailed information regarding these facilities may be found in the Visitor Services Service Plan (1982). (See Figure O-1.)

Table O-5 outlines the percent of respondents using Park services and facilities.


Little O'Cook Lake
20
Lake
Frozen
Still Brook
Ocean
Lake
10
Dennis Boot Lake
Channel Lake
Little River
Inness Brook
20
Little Liberty Lake
Little Liberty Brook
Liberty Lake
West River
Liberty Brook
Luxie Cove
Mount Tom Lake
Mount Tom Brook
Kejimkujik Lake
Luxton Lake
Poplar Lake
High Lake
Big Red Lake
Ben Lake
North Cranberry Lake
Mountain Lake
Puzzle Lake
10
Peskawa Lake
Peskowesk Lake
10
Beaverskin Lake
Beaverskin Brook
Cobrielle Lake
Pebbleloggitch Lake
Back Lake
Hilchemakaar Lake
Peskowesk
20
Mud
Lak

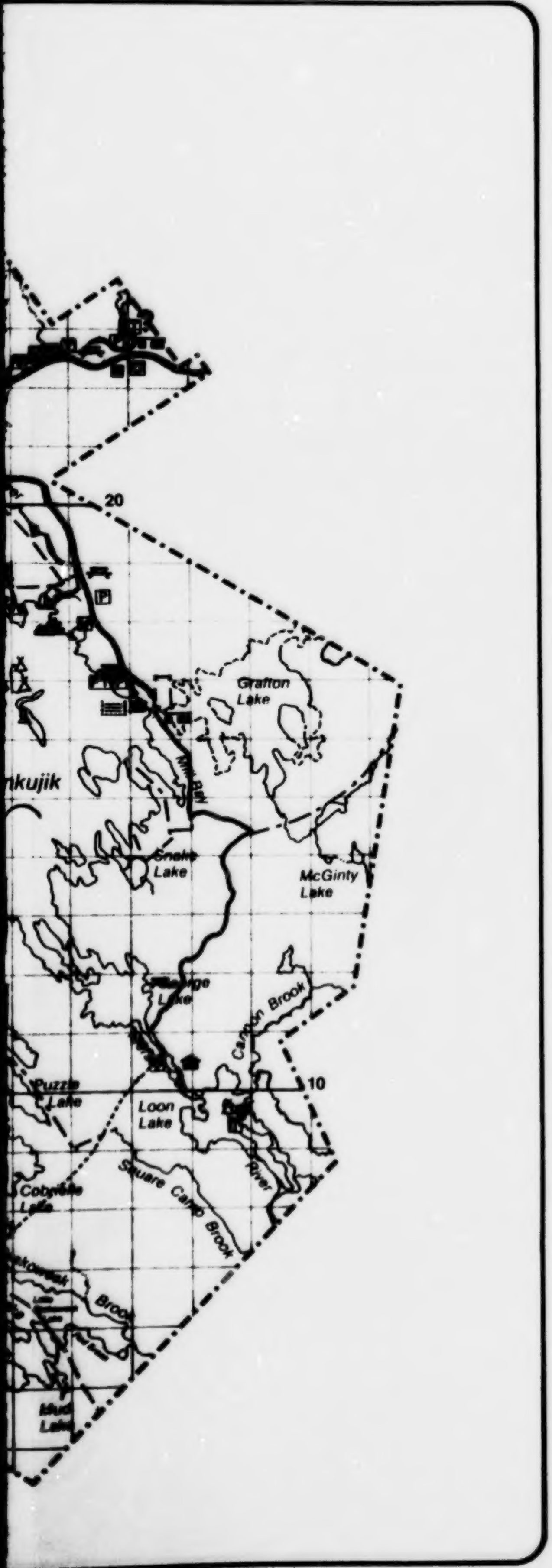

20
Grafton Lake
nkujik
Snake Lake
McGinty Lake
Cannon Brook
Puzzle Lake
Loon Lake
10
Square Camp Brook
River
Cobrielle Lake
Brook
Mud Lake

Figure 0-1

Facilities

LEGEND

Main Road	━━━
Secondary Road	───
Hiking Trail	-·-·-
Seasonally Closed Road	───
Bridge	)(
Portage	〰〰
Camping	▲
Group Camping	▲
Primitive Camping	Δ
Warden Patrol Cabin	●
Fire Tower	■
Supervised Beach	▬
Boat Launching	▲
Canoe Rental	▲
Picnic	▬
Information and Administration	?
Amphitheatre	●
Viewing	▣
Parking	P
Canteen	■
Showers	S
Sewage Disposal	▣
Maintenance	▣

Kejimkujik National Park

Parks Canada   Atlantic Region

Miles 1 0 1 2 3

Metres 1000 0 1000 2000 3000 4000

Yards 1000 0 1000 2000 3000 4000

1:100,000

N

Figure 0-2 Visitation to Kejimkujik National Park, 1985-86

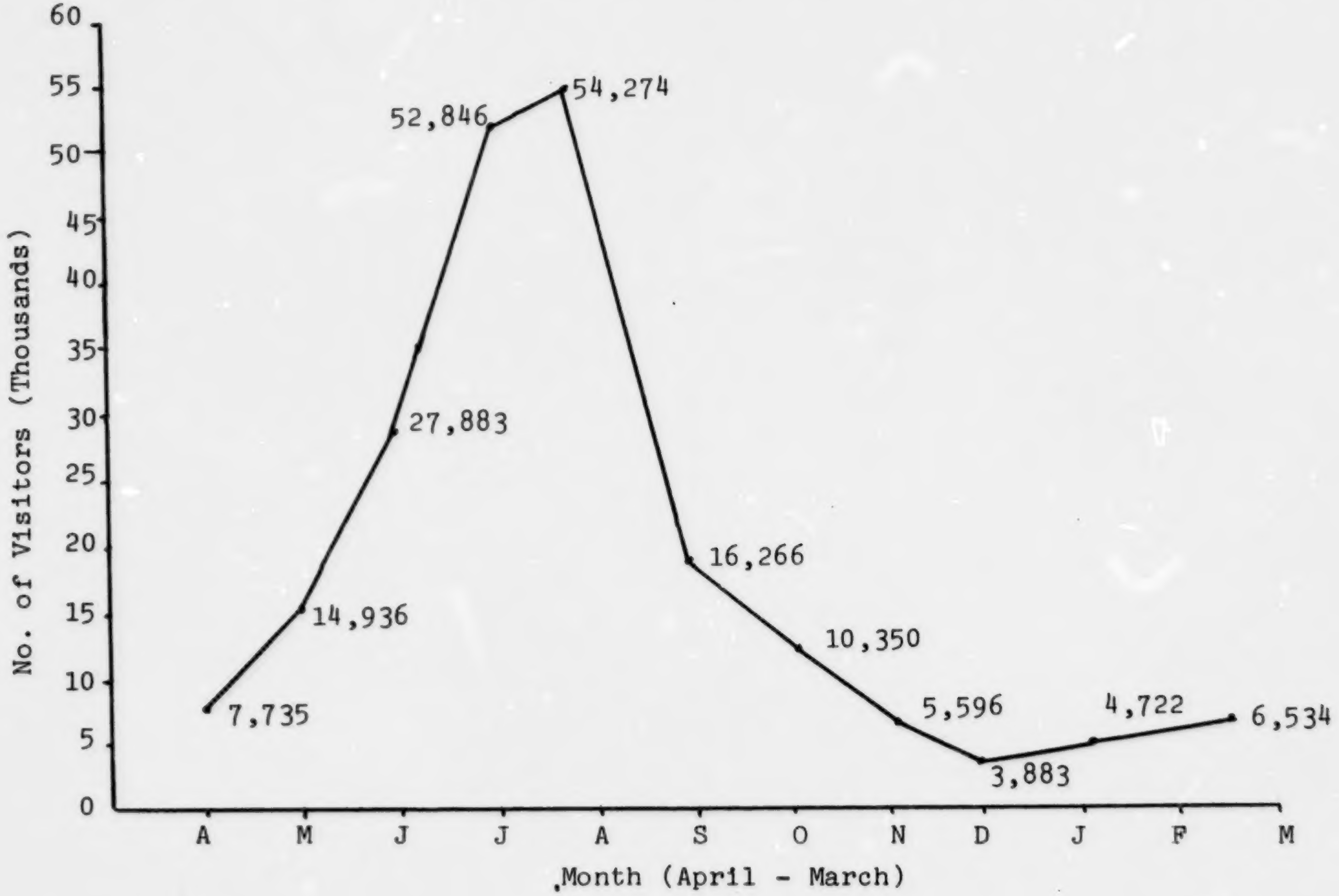


Table O-4 Summer Season Activity Segments (Visitor Description Market Facts, 1984)

	Total	Main Park Campers	Picnickers	Back-country Campers	Day Canoers/ Hikers
Base	789	424	177	132	56
Outdoor experience (%)					
Novice	14	14	22	9	9
Intermediate	52	56	46	48	54
Experienced	34	31	33	44	37
Party Composition (%)					
Family	75	81	73	56	77
Friends	19	13	23	31	16
Group	4	3	1	10	4
Alone	2	1	2	3	4
Average No. in Party	4.2	4.3	4.1	4.4	3.6
Length of Stay					
1 day	30	11	86	13	38
2-3 days	31	35	11	45	31
4-7 days	25	33	2	31	25
8-14 days	13	18	1	13	6
15 days or more	2	3	-	-	-
Average length of stay	4.1	5.3	1.4	4.3	3.1
KNP was stopover on extended trip (%)	27	22	44	23	44
KNP was highlight of that trip (%)	75	68	79	88	80

Table 0-5 Percent of Respondents Using Park Services and Facilities in 1982

Facility	Did Use (%)
Trails	86
V.R.C.	82
Beaches	77
Semi-serviced Site	73
Shower Building	68
Canteen	64
Picnic Sites	63
Exhibit Centre	56
Outdoor Theatre	52
Playgrounds	50
Guided Walks	39
Boat Landing	37
Boat Rentals	37
Guided Paddles	25
Children's Program	21
Backcountry Campsite	20
Group Campsite	10
Bilingual Services	8

Recreation Activity - Facilities:

Semi-serviced Camping

Kejimkujik has a single semi-serviced campground at Jeremy's Bay (Figure O-3). It comprises three areas: Meadow (Figure O-4), Slapfoot (Figure O-5), and Jim Charles (Figure O-6); and contains a total of 329 sites (Table O-6).

All sites (with the exception of walk-in sites, which have no on-site parking) have:

- identification numbered post
- parking area
- picnic table
- tent pad
- fireplace
- garbage can

All sites are in woodland; parts of Meadow, all of Slapfoot and all of the Jim Charles area are in mixed wood (ranging from nearly pure hardwood to nearly pure softwood) stands and about fifty percent of the Meadow Area is classified as a pure hardwood stand.

Cold potable water is provided by stand-pipes throughout the camping areas, and nine electrically-lighted service buildings provide hot and cold running water, hand basins, and flush toilets. A shower building, trailer dumping station, and firewood yard are centrally located. An outdoor theatre on the campground access road and bulletin boards are provided by the Interpretive Service.

Figure 0-3

Jeremy's Bay Camping Area

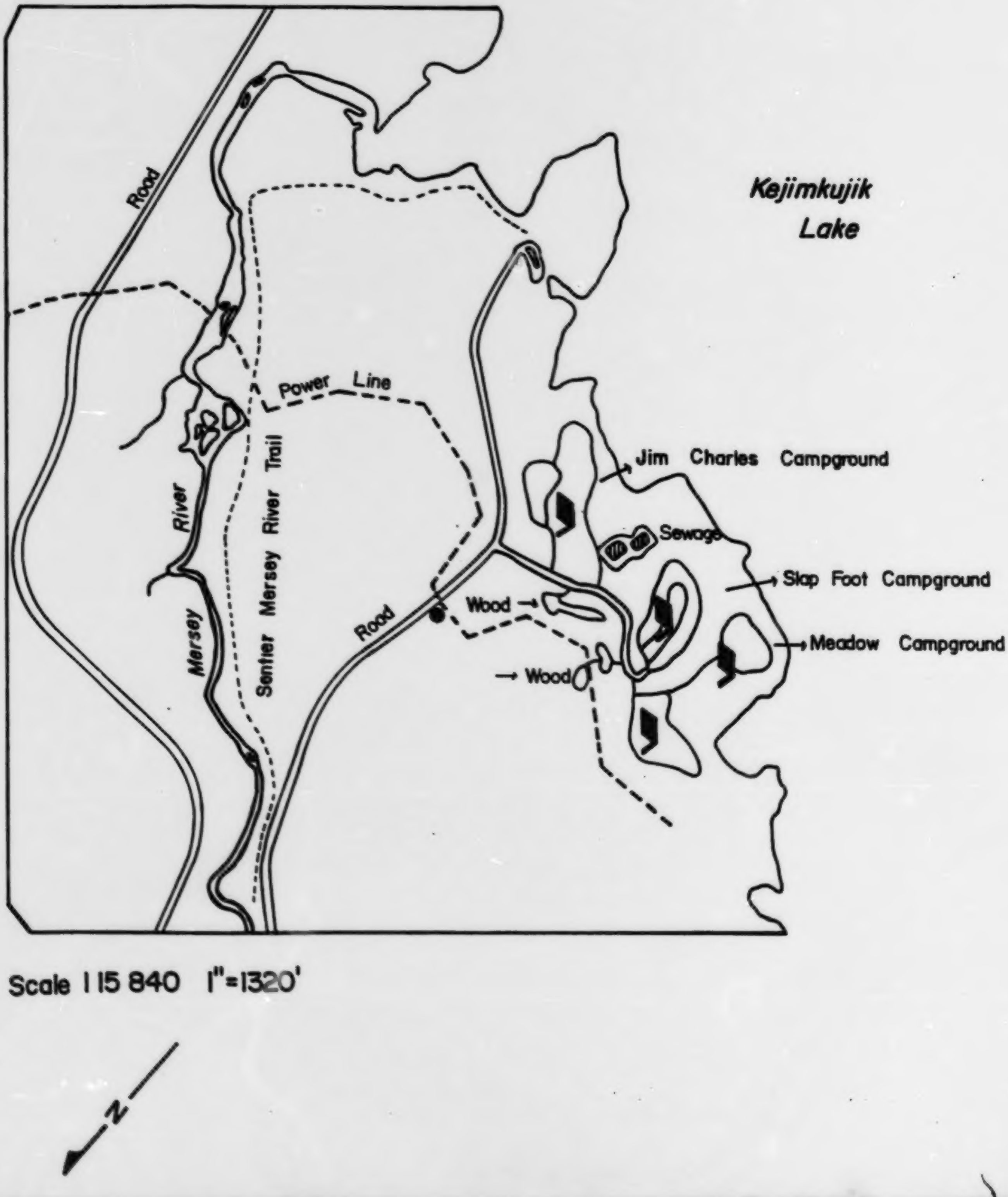

Road
Kejimkujik Lake
Power Line
Jim Charles Campground
Sewage
Slap Foot Campground
Meadow Campground
Wood
Wood
River
Mersey
Sentier Mersey River Trail
Road
Scale 1:15 840 1"=1320'
N

Figure 0-4

Meadow Campground

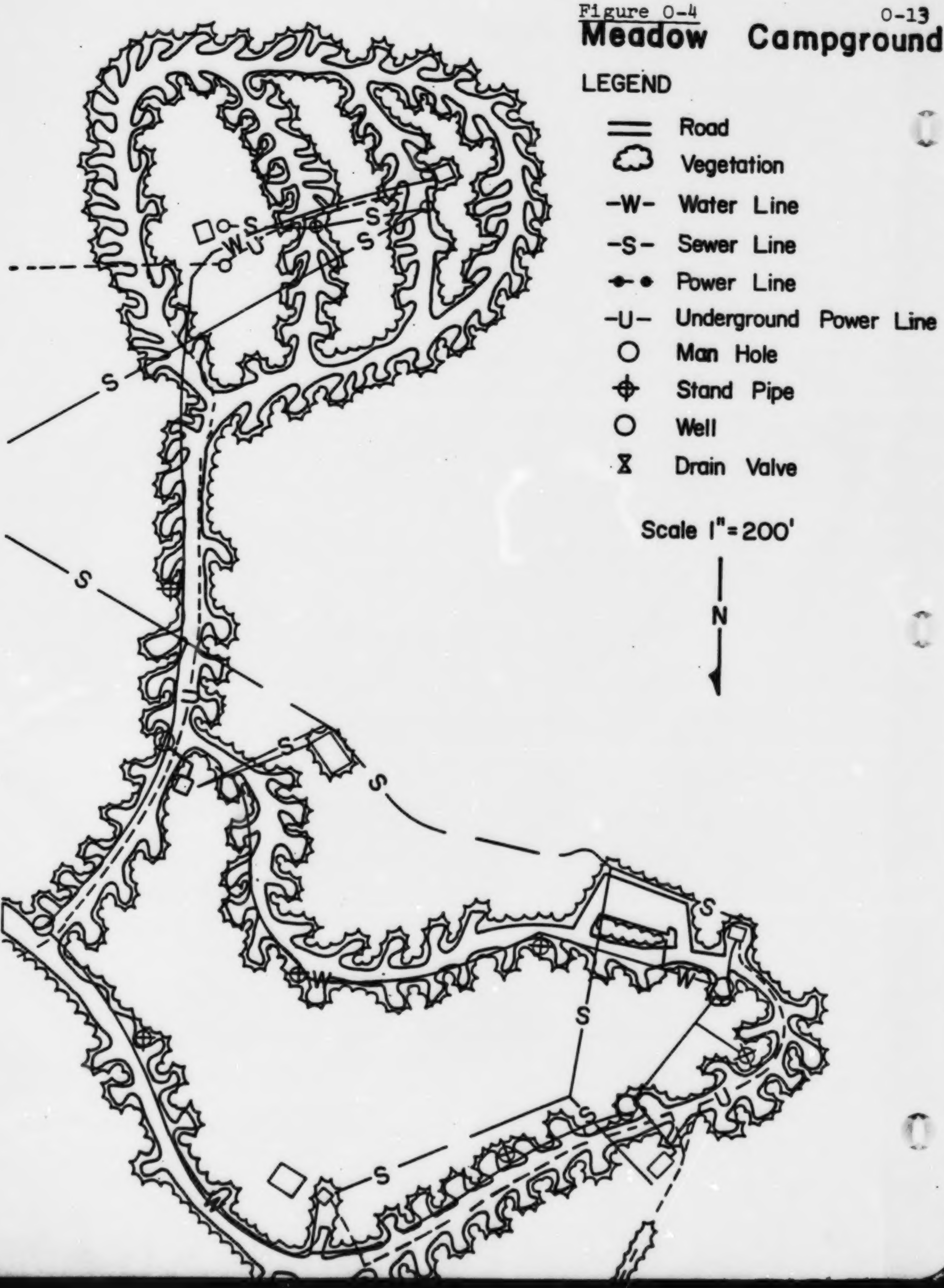

LEGEND
═ Road
Vegetation
-W- Water Line
-S- Sewer Line
-•- • Power Line
-U- Underground Power Line
○ Man Hole
⊕ Stand Pipe
○ Well
⧗ Drain Valve
Scale 1" = 200'
N
S
W
U

Figure 0-5

Slap Foot Campground

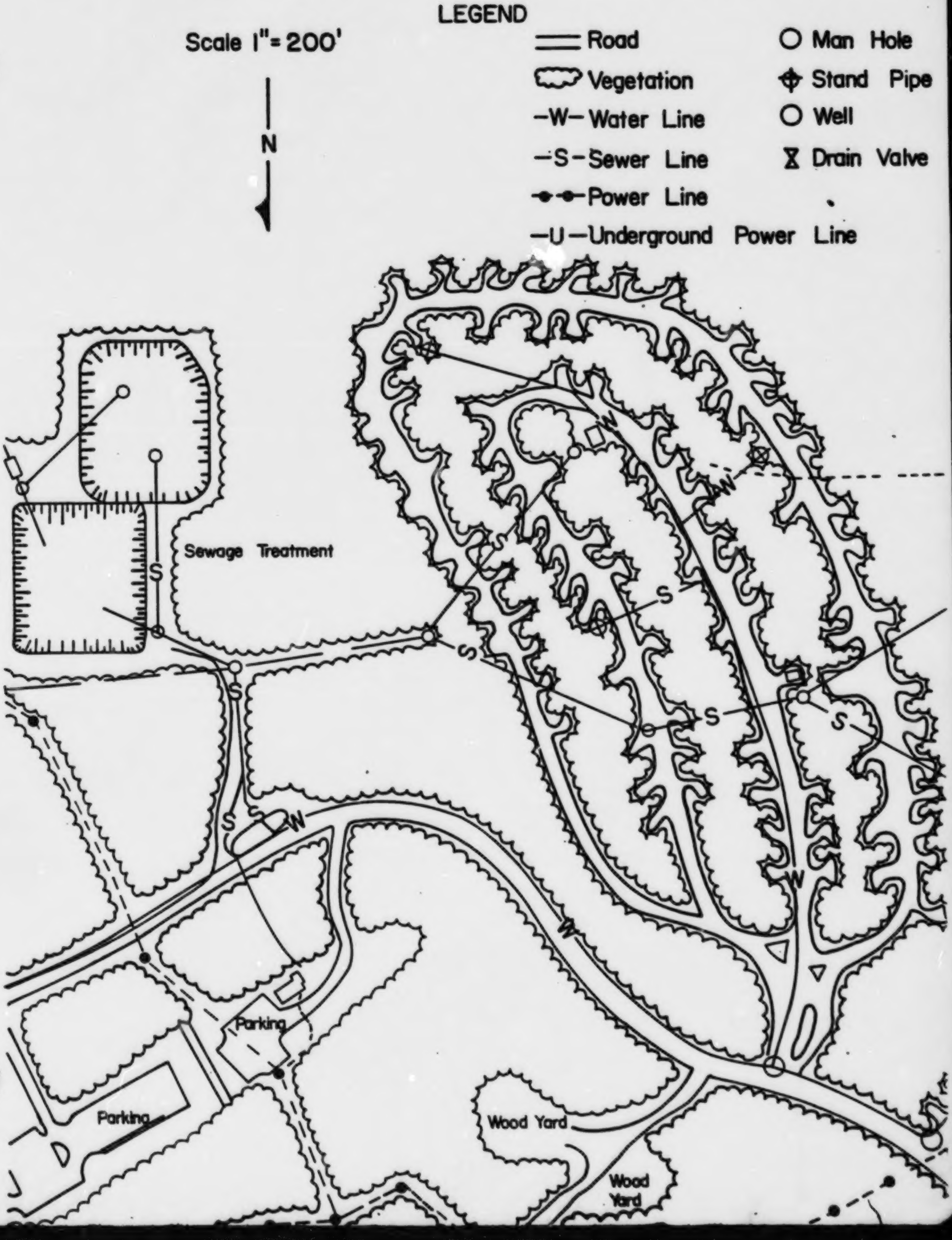

LEGEND
Scale 1" = 200'
N
Road
Vegetation
W Water Line
S Sewer Line
Power Line
U Underground Power Line
Man Hole
Stand Pipe
Well
Drain Valve
Sewage Treatment
S
W
Parking
Parking
Wood Yard
Wood Yard

Figure 0-6

Jim Charles Campground

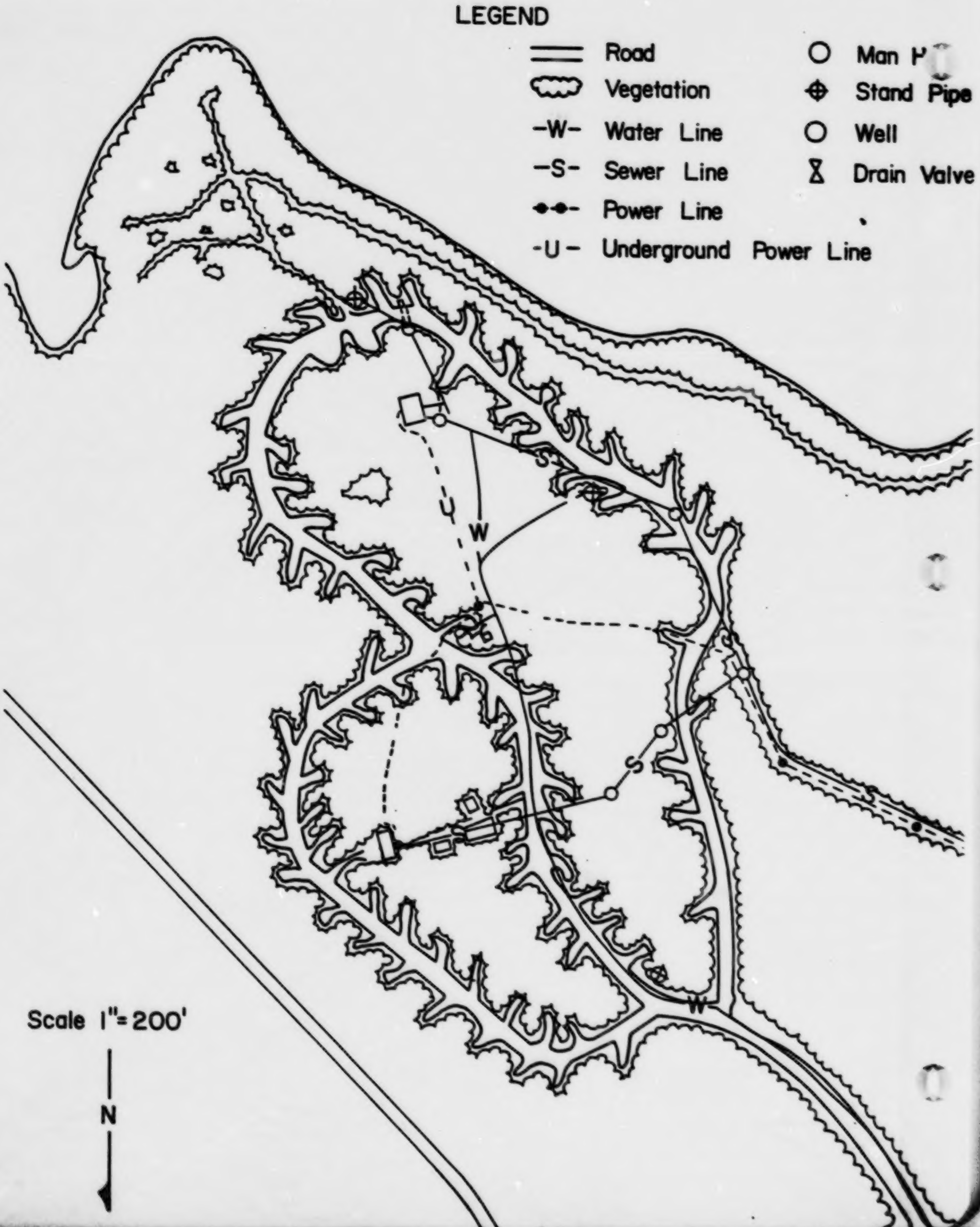

LEGEND
Road
Vegetation
-W- Water Line
-S- Sewer Line
Power Line
-U- Underground Power Line
Man H
Stand Pipe
Well
Drain Valve
S
U
W
S
W
Scale 1"=200'
N

Table 0-6 Semi-serviced Campsites in Jeremys Bay

		Can be used by:		
Site No.	Large Trailer	Small Trailer	Tent Trailer	Tent Only
Meadow 1-110	6 (2 pull-through)	29 (4 wheelchairs only)	58	17
Meadow 111-154	0	11	24	9
Slapfoot	12 (9 pull-through)	34	40	2
Jim Charles (1 unused)	0	19	55	13 (10 walk-in only)

Note: Any site can be used by the shelter(s) to the right of it on this table; i.e. a large trailer site can be used by a small trailer, tent trailer, or tent; a tent trailer site can also be used by a tent, etc.

Group Camping

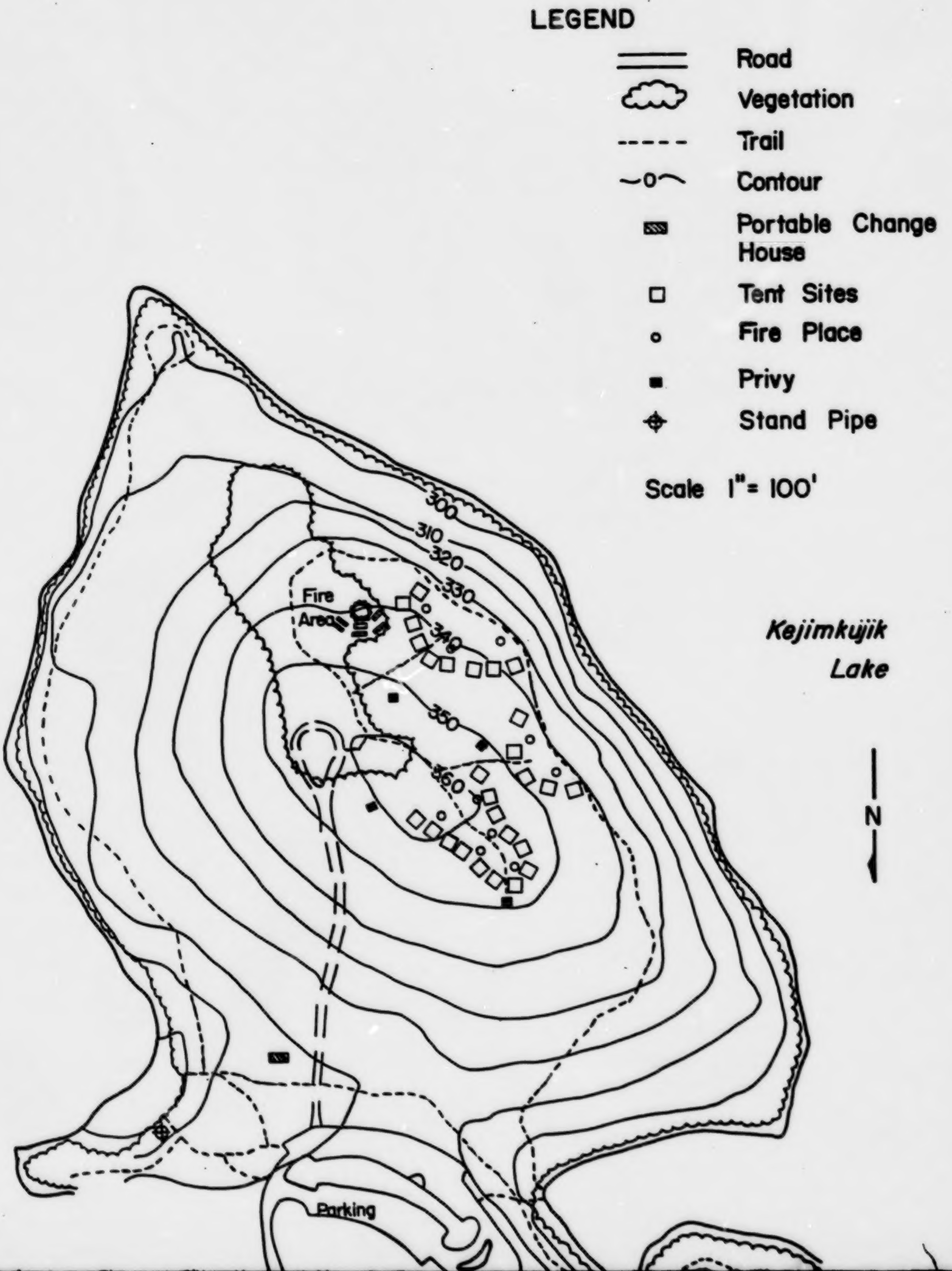
A single group campground, at Jim Charles Point, is provided for groups camping in the Park (Fig. 0-7). It consists of four areas containing a total of 29 tent pads. Site One is an open area, and contains nine tent pads; Sites Two, Three and Four are in mixed wood and provide nine, seven, and four tent pads respectively. There is one fireplace and one or more picnic tables. One grease disposal pit serves the sites, and other facilities are shared by all groups. A single service building located near Site One contains stoves, picnic tables, bulletin boards and food storage cupboards. Water (a hand pump), a firewood pile, a flag-pole, and a bulletin board are provided adjacent to the shelter. One vault and three pit toilets are provided. A group campfire circle with benches and an open field area occupy the hillside below the shelter. Alongside the campfire circle is a flat, grassed, play area (formerly a tennis court). Swimming and water-front facilities are provided at Kedge Beach (see below under specific activities).

Backcountry Camping

There are 44 backcountry campsites within the Park in Class Two and Three areas. Some distinction is made between those provided for canoeists and for hikers. The locations and capacities of these sites are described in Table 0-7. Each site contains one or more tent pads, site marker(s), pit toilet and fire pit(s). Open-front Adirondack-type shelters are provided at Sites 8 (Frozen Ocean Lake), 11 (Moose Island, Kejimkujik Lake) and 23

Figure 0-7

Group Camping Area


LEGEND
Road
Vegetation
Trail
Contour
Portable Change House
Tent Sites
Fire Place
Privy
Stand Pipe
Scale 1" = 100'
300
310
320
330
340
350
360
Fire Area
Kejimkujik Lake
N
Parking

(Loon Lake). At Site 37 (Pebbleloggitch Lake), a lumberman's cabin has been refurbished for use by campers. It contains a table, bunk beds, and a wood stove.

For canoe campers, twenty-four portages (lettered A-W) are provided (Table 0-8). One small carry, from Lower to Upper Silver Lake, has no designation. These portages range from one-tenth of a kilometre to two and four-tenths kilometres in length. All are single lane trails. Most are simple, grubbed-out trails approximately one metre in width. Where traffic or soil base conditions warrant, portages have been gravelled. In addition, Portages T and W are constructed of boardwalk over most of their length. On all others, only short boggy stretches have boardwalks. On all portages over four-tenths of a kilometre in length, canoe rests and benches are provided every four-tenths of a kilometre. Fluorescent orange lettered markers mark each end of every portage. In the following instances, docks are provided at portage ends.

Portage	End
A	North Cranberry Lake
B	Puzzle Lake
Q	Big Dam Lake
R	Both ends

Two major hiking trails are provided for primitive campers: Liberty Lake (55 km) and Channel Lake (19 km). The West River and Luxton Lake Trails (about 7 km each) and Little Peskowesk Lake Trail (about 5 km) are branches from the Liberty Lake Trail.

Table 0-7 Primitive Campsites

Site No.	Location	# Parties	Max. No. People
A	East, Big Dam	2	2,2
B	East, Big Dam	1	6
C	East, Big Dam	1	8
D	East, Big Dam	2	2,2
1	East, Big Dam	1	2
2	South west, Big Dam	1	4
3	North east, Big Dam	1	2
4	Little River, Big Dam Portage R	1	2
5	Little River, at Frozen Ocean	3	4,4,4
6	East, Frozen Ocean	1	4
7	West, Frozen Ocean	3	2,2,2
8	South east, Frozen Ocean	1	8
9	South, Channel Lake	2	4,4
10	Little River, south of Portage V	2	4,4
11	Moose Island, Kej. Lake	2	6,4
12	Northeast, Ritchie Island	1	8
13	South, Ritchie Island	1	4
14	West, Ell Island	1	4
15	Big Muise Island	1	4
16	Island, mouth of Mt. Thom Brook	1	6
17	North, Channel Lake	1	6
18	East, Minard's Bay, opposite	3	2,2,2
21	West River	1	4
22	West River	1	2
23	Long Point, Loon Lake	1	2
24	Minard's Bay, Kej. Lake (A)	1	6
25	North, Mountain Lake	2	6,4
26	East, Mountain Lake	1	6

Table 0-7 (cont.) Primitive Campsites

Site No.	Location	# Parties	Max. No. People
27	North east, Cobrielle Lake	1	6
28	Peskowesk Brook	3	6,4,4
29	Island, east Peskowesk Lake	1	8
30	Southeast, Lower Silver Lake	1	2
31	Northeast, Peskowesk, Portage F	1	6
32	Isle de l'Orignal, Peskowesk	1	2
37	Portage M, Pebbleloggitch Lake (Masons Cabin)	2	8
38	Poison Ivy Falls, Portage N	1	6
39	Southeast, Luxton Lake	1	2
40	North, Peskawa Lake	1	2
41	North, Little Red Lake	1	4
42	Southeast, Liberty Lake	1	4
43	Inness Brook	1	2
44	Stewart Brook	1	2
45	North, Frozen Ocean	1	2
46	Torment Brook, Frozen Ocean	1	2

Table 0-8 Portages

Portage	Length
A	1.2 km
B	.16
C and D	.4
E	2.4
F	.8
G	.8
H and I	.16
J	1.2
K	.4
L	.4
M	.2
N	.8
O	.8
P	.16
Q	.4
R	.8
S	.16
T	.16
U	.4
V	.8
W	.4

These trails have a largely unimproved base, with some bridging over bogs and shallow streams. The trail bases vary from 2.5 metre access roads and bombardier tracks to .3 metre paths. Directional signs mark trail forks and small coloured metal triangles fastened to tree trunks mark difficult-to-follow sections.

Demonstrations

No facilities are provided specifically for demonstrations.

Wildlife/Birdwatching

No special facilities provided.

Theatre Attendance

Two theatres have been constructed. An outdoor theatre at the Jeremys Bay area serves the semi-serviced campground and group campground and is open as well to other Park users.

An indoor theatre is part of the Visitor Centre at the Administration Office.

Walking

Fifteen walking trails, ranging from .25 to 5 kilometres, are available for summer use in the Park (Table 0-9). Nine of these are interpretive facilities. Of the others, Mersey River, Peter Point, and Snake Lake trails are designed primarily as recreational walking (experience) trails. Slapfoot, Jake's Landing and Merrymakedge Trails are for pedestrian circulation as well as recreational walking.

Within the Jeremys Bay semi-serviced campground a number of short (less than one-half km) trails for pedestrian circulation have been constructed. These total about one kilometre. These allow access to the outdoor theatre, the lake shoreline, and the Slapfoot Trail.

Walking trails have a gravelled or crushed rock surface and are usually a minimum of one metre in width. Merrymakedge and the Mersey Meadow Trail entrance are asphalt-paved to provide access for the handicapped.

Wet and rough areas are avoided or bridged. Of the trails whose main function is non-interpretive, only Snake Lake is a loop. The McGinty Trail is an old forest road and has a broad improved gravel base.

Exhibit Viewing

Other than interpretive exhibits, the only facility for exhibit viewing is the visitor centre (see Reception/ Orientation).

Day Canoeing

Parking lots provide access for canoeing at various locations including:

Table 0-9 Walking Trails

Trail	Length	Interp.	Loop	Old Road	Rolled Gravel	Asphalt
a Mill Falls	1.0 km	x			x	
b Beech Grove	1.5 km	x	x		x	
c Flowing Waters	1.0 km	x	x		x	
d Hemlocks & Hardwoods	4.0 km	x	x			
e Heber Meadow	1.2 km					
f Grafton Lake	1.6 km		x		x	
g Mersey River	5.0 km					
h Farmlands	1.2 km	x	x			
i Rogers Brook	1.0 km	x	x			
j Peter Point	2.0 km			x		
k Snake Lake	3.0 km		x		x	
l Slapfoot	3.2 km					
m Merrymakedge	.5 km					x
n Jake's Landing	.5 km				x	
o Mersey Meadow	.25 km	x	x			x
p McGinty Lake	2.0 km			x		

Jeremys Bay (Meadow Beach)
Kedge Beach
Administration Area
*Mersey River Picnic Area
Merrymakedge Beach
Grafton Lake
Lower Mersey River (Eel Weir)
**Big Dam Lake

*May not have sufficient water in a normal summer.
**Requires a portage to reach water.

The major canoeing facility is located at Jake's Landing on the Upper Mersey River. This consists of a parking lot, turn-around and launching area, docks, and a rental facility.

Relaxing

Benches are provided along some walking trails.

Photography

No special facilities provided.

Picnicking

Picnic facilities are provided at:

Location	Piped Water	Shelter	Pit or Chemical Toilet
Mill Falls	x	x	
Upper Mersey River			x
Jakes Landing	x		x
Merrymakedge (2 sites)	x x	x x	
Lower Mersey River (Eel Weir)			x
Kedge Beach	x		x
Indian Point (2)			x

Each consists of several tables on gravel pads, garbage cans, and trails for internal circulation. All except the two Indian Point sites are accessible by car and parking is provided. These two sites are accessible only by water.

Shelters are available in two areas. These buildings contain stoves, picnic tables, garbage cans, sinks with pressure water systems and flush toilets.

Tubing/River Floating

No specific facilities provided.

Kayaking

As in canoeing.

Painting

No specific facilities.

Swimming

Access to swimming areas is provided at Jeremys Bay Campground (Meadow Beach, Slapfoot Beach), Kedge Beach and Merrymakedge Beach.

Beach	Toilet	Canteen/ Change	Auto Access and Parking
Meadow Beach	x		x
Slapfoot Beach			
Kedge Beach	x		x
Merrymakedge Beach	x	x	x

The supervised beach at Merrymakedge provides a full change-house with stalls as well as toilet facilities and canteen building. The canteen building also houses a lifeguard room and first aid station. Two lifeguard chairs and a roped-off area constitute the supervision facilities.

Gabions stabilize the upper beach/forest-edge at Merrymakedge and Meadow Beach and both beaches have been artificially enhanced with additional sand and shaping.

Visiting Friends

A bulletin board at the campground kiosk allows friends and/or relatives to exchange messages.

Scientific Study

The Interpretation and Resource Conservation services provide support facilities for scientific study.

Day Hiking

No facilities are provided specifically for day hiking in the Park. However, the Fire Tower access road and portions of the hiking trails provided for primitive campers (notably Channel Lake Trail) also serve this activity.

Automobile Sightseeing

Five scenic viewpoints along the main Park highway were constructed to aid automobile sightseeing. Four are along the upper Mersey River and one overlooks Kejimkujik Lake. Each consists of a parking area and garbage containers. Several have interpretive exhibits and one connects with the Mill Falls trail.

Sailing

A boat launching ramp has been constructed at Jake's Landing, and numbered buoys mark safe channels in Kejimkujik Lake.

Wind Surfing

No specific facilities have been provided.

Bicycling

No bicycle trails have been constructed but most interpretive and information facilities (and some others) have bicycle racks. A rental concession is available at Jake's Landing.

Fishing

No specific facilities provided.

Orienteering

No specific facilities provided.

Rowing

Rental and launching ramp at Jake's Landing.

Serviced Camping

No facilities provided.

Hostelling

No facilities provided.

Scuba/Skin Diving

No facilities provided.

Horse Riding

While special facilities are not provided, gravel roads and road shoulder can be used by riders.

Power Boating

Facilities at Jake's Landing (see Canoeing, Sailing) are provided for power boating, and access to the Lower Mersey River is provided at the Eel Weir.

Non-mandate Activities

Playgrounds with swings, slides, and teeter-totters are provided at the Jeremys Bay Campground and at Merrymakedge Beach. A flat grassy area for sports is provided between the shower building and outdoor theatre.

For further detailed information regarding facilities and services for these activities, see "Visitor Services Service Plan", Wildlands Associates, 1983.

Visitor Segments:

By analyzing the summer visitor population, Wright and Robertson (1983) identified five visitor segments.

1. Those camping in the semi-serviced campground.
2. Those camping in the group campground.
3. Those day-users who come to see what the Park has to offer (sightseers).
4. Those who come to the Park to participate in a specific activity or activities, but not to camp (day-use recreationalists).
5. Those camping in back-country campsites.

Important characteristics of each segment are shown in the following pages.

Those camping in the semi-serviced campground:

Table 0-10 summarizes important characteristics of this segment.

Objectives

The objectives of managing for this group are:

1. Provide a high degree of camper satisfaction.
2. Minimize the impact of the campers on the Park's resources.
3. Maximize the exposure of campers to Park themes to the extent consistent with the preceding goals.

Table 0-10 Visitor Segment #1: Those Camping in the Semi-serviced Campground

Residence: Within 150 km 68%
U.S.A. 12%

Party Size: 2-5 86%

% of Park Users: 54%

Party Composition: Family 80%
Friends 36%
Alone 2%

Activity	% Participants	Benefit	% V-Ex. Important
Outdoor cook	94	Enjoy scenery	
Campfire	93	Enjoy natural surr.	86
Walking	93	Peace	80
Relaxing	92	Explore	65
Auto sightseeing	81	Do things with friends	55
Visit surr. area	80	Release tensions	53
Living skills	79	Learn about nature	52
Attend theatre	74	Remember after	48
Exhibit viewing	73	Be with others	47
Photography	68	Bring family together	46
Wildlife watch	68	Use equipment	32
Day hiking	60	Improve health	27
Day canoe	60	Challenge	22
Non-super. swim	59	Meet new people	19
Picnic	57	Share knowledge	23
Visit friends	54	Get in shape	19
Supervised swim	51	Develop skills	9
Biking	50	Party	9

Trends

Campground use peaked in 1980. There has been a slow decrease in summer use since that time. Nonetheless, the provincial economy is becoming (marginally) more buoyant, and most visitors are Nova Scotian. Over 1,000 parties are still turned away during peak periods due to lack of camping space.

Most Likely Visitor Use Scenario

Visitation continues to decrease slightly or remain stable.

Those Camping in the Group Campground:

Table 0-11 summarizes important characteristics of this segment.

Objectives

The objectives of managing for this segment are the same as for those camping in the semi-serviced campground.

Trends

No clear trend appears in group campground use. Numbers vary from 2,000 to 4,000. The year 1983 showed a large drop.

Table 0-11 Visitor Segment #2: Those Camping in the Group Campground

Residence:	Within 150 km.	52%	% of Park Users:		2%
	U.S.A.	26%	Party Composition:	Group	100%
Party size:	2-5	81%			

Activity	% Participants	Benefit	% V-Ex. Important
Relaxing	89	Enjoy natural surr.	92
Walking	85	Enjoy scenery	86
Outdoor cooking	81	Do things w. friends	74
Visit surr. area	67	Explore	65
Campfire	63	Peace	58
Photography	63	Be with others	56
Wildlife watching	59	Remember after	53
Exhibit viewing	56	Release tensions	48
Picnic	56	Share knowledge	46
Auto sightseeing	56	Learn about nature	43
Attend theatre	52	Bring family together	43
		Meet new people	39
		Use equipment	23
		Improve health	22
		Challenge	22
		Develop skills	13
		Get in shape	8
		Party	5

Most Likely Visitor Use Scenario

No real change in demand is anticipated.

Sightseers:

Table 0-12 provides a profile of this visitor group.

Objectives

1. To aid this segment in gaining an appreciation of the Park's role, resources, facilities and services.

2. To minimize the impact of this segment on Park resources.

Trends

Unfortunately, much of the present data does not differentiate between the two groups of day-users (this group and segment four). Since overall Park visitation has increased slightly since 1979, yet camping numbers are down, apparently day-use is increasing moderately.

Most Likely Visitor Use Scenario

This segment is the most liable to fluctuate, due to management and information policies. With the present thrust for Park and Nova Scotia promotion a moderate increase is likely.

Table 0-12 Visitor Segment #3: Sightseers

Residence:	Within 150 km.	64%
	U.S.A.	15%
Party size:	2-6	81%

% of Park users: with recreationalists = 40%

Party composition:	Family	76%
	Friends	23%
	Alone	1%

Activity	% Participants	Benefit	% V-Ex. Important
Walking	74	Enjoy scenery	86
Relaxing	73	Enjoy natural surr.	84
Auto sightseeing	65	Exploring	68
Picnicking	57	Be with others	51
Exhibit viewing	52	Do things with friends	46
Wildlife watching	51	Learn about nature	46
		Release tension	41
		Remember after	40
		Bring family together	37
		Peace	37
		Share knowledge	28
		Meet new people	26
		Improve health	23
		Challenge	23
		Use Equipment	19
		Get in shape	9
		Party	5
		Develop skills	4

Day Use Recreationalists:

Table 0-13 summarizes important characteristics of this segment.

Objectives

1. To aid this segment in achieving their recreation goals.
2. To help them gain an appreciation of the Park's role, resources, facilities, and services.
3. To minimize their impact on Park resources.

Trends

No figures are available to separate this group from the sightseers.

Most Likely Visitor Use Scenario

Growth of this segment probably depends entirely on promotion and provision of services/facilities. Numbers will probably remain fairly stable.

Primitive Campers:

Table 0-14 summarizes important characteristics of this segment.

Table 0-13 Visitor Segment No. 4: Day-Use Recreationalists

Residence:	Within 150 km.	68%	% of Park Users:	with sightseers = 40%	
	U.S.A.	15%	Party composition:	Family	78%
Party size:	1-6	86%		Friends	18%
				Alone	4%

Activity	% Participants	Benefit	% V-Ex. Important
Relaxing	84	Enjoy scenery	81
Picnicking	78	Enjoy natural surr.	81
Walking	74	Peace	72
Wildlife watching	64	Exploring	57
Photography	62	Learn about nature	50
Auto sightseeing	61	Remember after	48
Exhibit viewing	55	Do things with friends	44
Outdoor cooking	54	Release tension	41
Visit surr. area	54	Bring family together	41
Day canoeing	54	Be with others	36
		Improve health	21
		Challenge	19
		Use equipment	18
		Get in shape	16
		Share knowledge	16
		Meet new people	10
		Develop skills	5
		Party	2

Objectives

1. To provide an opportunity for visitors to enjoy a successful primitive camping experience.
2. To minimize the impact of this segment on the Park's resources.
3. To make them aware of the Park's role and resources, insofar as this does not conflict with the preceding objectives.

Trends

Primitive camping numbers peaked in 1980 and have decreased 10% since 1979.

Most Likely Visitor Use Scenario

With private industry and government promoting camping heavily, demand for this experience should remain stable or increase slightly.

Table 0-14 Visitor Segment #5: Those Using Primitive Campsites

Residence:	Within 150 km.	64%	% of Park Users:		5%
	U.S.A.	19%	Party Composition:	Family	52%
Party size:	2-5	78%		Friends	45%
				Alone	3%

Activity	% Participants	Benefit	% V-Ex. Important
Outdoor cooking	94	Enjoy natural surr.	89
Relaxing	91	Enjoy scenery	86
Campfire	90	Peace	78
Wildlife watching	82	Exploring	67
Walking	82	Do things with friends	56
Living skills	78	Release tensions	53
Overnight canoe	67	Be with others	51
Visit surr. area	63	Enjoy nature	44
Photography	61	Challenge	42
Day canoe	58	Remember after	35
Exhibit viewing	52	Bring family together	34
Non super. swim	51	Develop skills	31
		Improve health	29
		Get in shape	23
		Share knowledge	23
		Use equipment	23
		Meet new people	12
		Party	4

Regional Setting:

The most significant market area has been (and probably will continue, in the short term at least, to be) a group who travel only a short distance, by auto, to reach the Park.

Park visitors gave high ratings to the present blend of outdoor activities, peaceful, natural surroundings, and such capital intensive facilities as visitor centres, showers, heated washrooms, and semi-serviced campsites. This "mix" is not in large supply in the relatively short distance most of the present visitors are travelling.

The obvious "competitive" facilities are the other National Parks in the Maritimes: Fundy, P.E.I., Kouchibouguac, and Cape Breton Highlands. Kejimkujik is closer than any of these others to the population areas it serves, however. Prince Edward Island National Park may also lack the expectation of peace and tranquillity, and the availability of semi-serviced sites.

To date, most provincial parks in the Maritimes lack the capital-intensive facilities such as heated washrooms, showers, and semi-serviced sites. Their capacities also tend to be small, although 1980 statistics on provincial campgrounds (Maritime Resource Management Service, 1981) suggest that there is "a substantial amount of unutilized capacity throughout the operating period

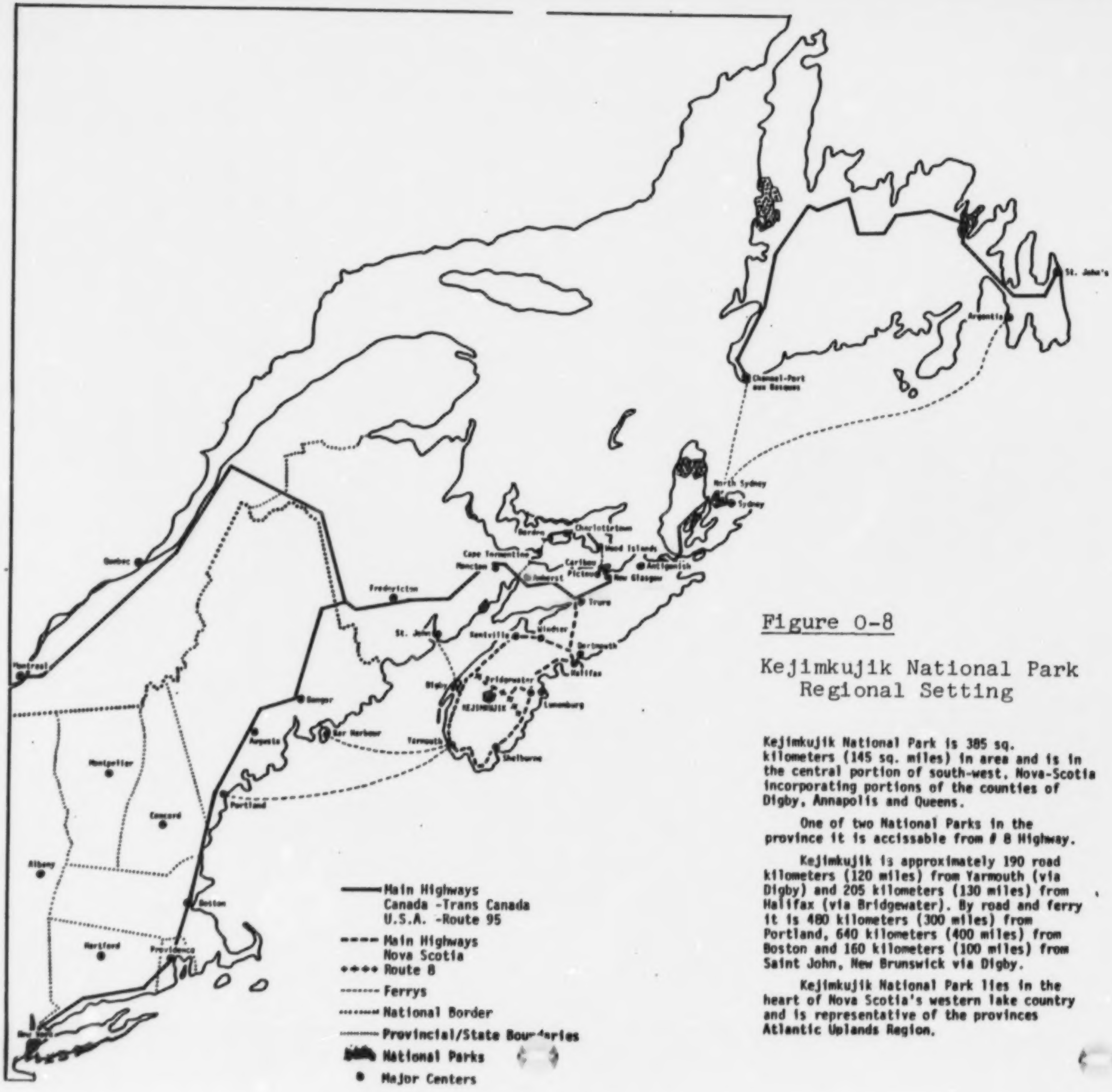

St. John's
Argentia
Channel-Port aux Basques
North Sydney
Sydney
Charlottetown
Borden
Wood Islands
Cape Tormentine
Moncton
Caribou
Pictou
Amherst
New Glasgow
Antigonish
Truro
Fredericton
St. John
Kentville
Windsor
Dartmouth
Halifax
Digby
Bridgewater
KEJIMKUJIK
Lunenburg
Yarmouth
Shelburne
Quebec
Montreal
Bangor
Augusta
Bar Harbour
Portland
Montpelier
Concord
Albany
Boston
Hartford
Providence
New York
Main Highways Canada -Trans Canada U.S.A. -Route 95
Main Highways Nova Scotia
Route 8
Ferrys
National Border
Provincial/State Boundaries
National Parks
Major Centers

Figure 0-8

Kejimkujik National Park Regional Setting

Kejimkujik National Park is 385 sq. kilometers (145 sq. miles) in area and is in the central portion of south-west, Nova-Scotia incorporating portions of the counties of Digby, Annapolis and Queens.

One of two National Parks in the province it is accissable from # 8 Highway.

Kejimkujik is approximately 190 road kilometers (120 miles) from Yarmouth (via Digby) and 205 kilometers (130 miles) from Halifax (via Bridgewater). By road and ferry it is 480 kilometers (300 miles) from Portland, 640 kilometers (400 miles) from Boston and 160 kilometers (100 miles) from Saint John, New Brunswick via Digby.

Kejimkujik National Park lies in the heart of Nova Scotia's western lake country and is representative of the provinces Atlantic Uplands Region.

in the government-operated campgrounds. It has been indicated that this is also typical of private campgrounds in the region . . . It can be assumed that there are sufficient campsites to meet the existing and the foreseeable demand".

Markets:

No information on markets or potential users is available other than what has been determined from the earlier analysis of present users. The possibility of extending this information to produce an approximation of the market served is poor. Nonetheless, this method will be used for creating options in this report, since this is the only data available.

Trends:

General

At present, only 28% of Kejimkujik's visitors are not residents of Nova Scotia.

Since 1971, visitation to Canada from the United States has declined (Tourism in Canada Projections, 1978). This same report projects an increasing visitation to Canada from the United States beginning in 1981.

The percentage of time taken by Canadians travelling within Canada has also declined significantly since 1971 (*loc. cit.*). The Canadian Travel Survey Research Bulletin

(No. 17, 1983) indicates that there has been an 8.4% decrease in person trips in Canada since 1980, largely due to unfavourable economic conditions.

The Nova Scotia Department of Tourism states that non-resident motor vehicle travel to Nova Scotia was the same in 1982 as in 1981.

Departments of Tourism are trying to increase the non-resident visitation to Canada as a whole. If they are successful it may be possible that there will be an increase in non-resident travellers to Nova Scotia, in general, and to Kejimkujik in particular. In the short term, however, the data do not suggest a significant change in the numbers of non-residents visiting Kejimkujik. While the actual numbers of visitors to Nova Scotia may not change significantly, the characteristics of the visitors will change. The Nova Scotia Department of Tourism suggests that the province as a whole will experience a changing market environment for tourists.

> In the next ten years important changes will occur in the tourism market. Nova Scotia's traditional market has been the travelling family from central-eastern Canada and the northeastern states, in cars or larger recreational vehicles.
>
> More women in the labour force will generate more discretionary income for two-income childless couples or retired people.
>
> With fewer children in the population, family travel will decline.

> Early retirement and aging trends means a population with more older people; there will be a significant segment of middle-aged and elderly travellers.
>
> The rising cost of gasoline and the use of smaller vehicles will reduce family travel but there will be growing popularity of package and group travel, bus tours, fly/drive packages and specific vacation experiences.
>
> (Provincial Tourism Master Plan, 1983)

The Parks Canada Research News (Vol. 3, No. 4, Winter, 1978) made similar projections with regard to the changes in the tourist population for Canada. The report goes on to suggest that National Parks located in the Atlantic Region can expect an increase in the proportion of tourists compared to local residents, and this will tend to intensify peak periods of use which correspond to the tourism season. The increasing number of people without children (both elderly people whose children have left home, and younger people with no children) will mean a greater freedom of the population to use Parks in shoulder season, and off-season.

Nova Scotia Residents

Most of the visitors to Kejimkujik are residents of the province, families from within 150 km of the Park. This is the major segment of Park users, and while other segments (non-residents) should not be ignored in terms of planning/management decisions, the major focus of attention will rest on this "native" group of people and the possible changes that this segment is likely to undergo.

It is of interest to note that during the period of 1974-1982 there was a 33% increase in camper nights at Kejimkujik, while Cape Breton Highlands showed a decrease of 23% during that period. This may be a reflection of the decrease in travellers from outside the province, since the Cabot Trail has been a traditional destination point for these visitors. It may also reflect growth due to people discovering the relatively new park.

The trends within the population of Canada can be applied to the resident population of Nova Scotia as well. Specifically, the population as a whole is aging; that is, older people will make up a much larger percentage of the population than they do at present. For the country as a whole, there will be 100,000 more people over the age of 65 by 1990 than there are now. Persons between 20 and 44 at present (the so-called baby-boomers) will also be aging, and they seem to be having relatively few children. The Parks Canada research news bulletin (Winter, 1978) suggests that for various reasons, these people will be more free to utilize the Park during shoulder and off-seasons.

The older population segments may not be as interested in very active forms of recreation such as long distance hiking or canoeing. However, increased interest in fitness and skill development at present may result in an older population which will be more active than elderly people of today. An overall decline in the number of young families, at present the largest user group at Kejimkujik, may also affect the demand for very active forms of recreation.

During the last few years, part-time enrollment at adult night classes, job skill courses, upgrading courses, etc. has increased. Reilly (1983) suggests that as the population becomes generally older and part-time enrollment increases, the population will be proportionately better educated. With this increased level of education, there will be an increased demand for quality products and experiences, and for many, travel will be a logical extension of the education process. It may be implied from this that those who use parks will become increasingly concerned about the quality of the environment.

Further to this, the trend toward more and more urbanization will mean that by 1991 more than 75% of Canadians will be living in major cities. In the past, increased urbanization has led to a growth in popular concern for the preservation of the natural environment. In Nova Scotia, the population appears to be increasing very slowly (858,000 in July 1981, to 863,000 in July 1982) at the present time, probably reflecting the migration of younger people to larger centres in Canada in search of employment. However, if economic outlooks become favourable (e.g. offshore oil and gas) it would be probable that Nova Scotia could see a large influx of people to major development areas. Halifax-Dartmouth would be one of these major areas, and it would be expected that Kejimkujik could experience an increase in demands for outdoor recreation opportunities.

At the present time, it does not appear that this large influx will occur within the next five years.

Park

Use of Park facilities and changes in the five years since 1979 are shown in Table 0-15. All counts show a peak in the years 1980-82, and a decline since then. Camping has declined about four per cent, and Park visitation is up about five per cent, suggesting an increase in day visitors. The overall picture is one of fluctuation both up and down, with no specific trends apparent.

Types of Use

Outdoor recreation is directly tied to the amount of time an individual has to partake of it . . . his leisure time. In Canada, more people are working, but fewer are working more than 45 hours a week (since 1971). This would suggest that people in general would have more time to visit a Park, for example. However, there are two factors which prevent this from happening. Firstly, many of the people working have part-time jobs, and secondly, many young couples both have jobs. In each case, finding a block of time in which to visit the Park, from Halifax-Dartmouth, for instance, may be difficult for them. The increased cost of travel is also a factor to be considered. It is implied from this that people in the work force will probably visit the Park closest to them, they may stay longer, and generally may travel less during their vacation periods than in the past.

At Kejimkujik, the traditional core activity of the Park visit has been camping. The great majority use the semi-serviced campground facility, but there is a significant segment who also use the back-country facility as a part of, or the whole of, their Park experience. Wright and Robertson (1983) suggest that there is a new generation of modern campers emerging.

> The "traditionalists" are characterized by their purist philosophy. They come to the parks for solitude, and to live a primitive life-style in a natural setting. They enjoy making their own decisions about what to do during the visit. The "modernists" hold and portray urban values. They see parks as a place to meet others and socialize. Their equipment is usually sophisticated enough to allow them to enjoy the conveniences of home. Often they want packaged vacations, where the programs are organized, and they only need to arrive on schedule.
>
> (Segmentation Study, K.N.P., p. 70)

The data available to date do not indicate an increase in demand for more and more sophisticated facilities, and most Park users liked the facilities as they are. However, visitor attitudes and expectations in the future may show this trend as occurring. If it does, planners and managers will have to balance the provision of such facilities and the overall quality of the camping experience in a natural environment. Clawson and Knetsch (1966) suggest that the public can be educated to appreciate a high quality outdoor/natural experience by exposing Park users to good quality.

> It seems highly probable that people can be taught to appreciate quality in outdoor recreation . . . Familiarity with the good, and explanation of why those with more experience rate it as good, can do much to build appreciation.
>
> (Clawson and Knetsch, 1966, p. 166)

Table 0-15 Use of Park Facilities 1979-1983 (June 1 - August 31)

Facility	Year				
	1979	1980	1981	1982	1983
V.R.C.	19,098	22,862	21,573	15,627	16,109
% Change since 1979		+2	+1	-2	-1.5
Group Campground	2,867	2,000	3,404	4.034	3,011
% Change since 1979		-30	+18	+40	+5
Backcountry Sites	5,258	6,178	4,297	5,030	4,693
% Change since 1979		+17	-18	-4	-10
Semi-serviced Campground	19,552	20,087	19,393	18,945	18,837
% Change since 1979		+2	--	-3	-4
Entrance Gate	122,994	132,620	134,833	122,085	129,486
% Change since 1979		+8	+10	--	+5
Merrymakedge Beach	11,154	12,658	12,936	14,203	12,945
% Change since 1979		+13	+16	+27	+16

This seems particularly applicable to a Park such as Kejimkujik whose chief attraction appears to be the unspoiled natural environment.

One type of visitation to Kejimkujik that may increase is "group" or bus tours. As a result of increasing costs of gasoline, etc., this type of travelling may appeal to more people of varying ages and backgrounds. The 1983 Interpretation Plan for Kejimkujik indicated that the most popular destination area of Nova Scotia's bus tour market was the South Shore. These visits occurred during July, August, and September, with September seeing 30% of the visits. At present, Kejimkujik has little to offer the kinds of people who use bus tours as such, but changing demands may result in a different type of "bus tour", with younger people who could take advantage of the Park experience, if the planning and management sectors within Parks should wish to promote this kind of activity.

Summary:

Although there are many conflicts within the various projections and reports referred to it would seem likely that demand will not change greatly for facilities at Kejimkujik. At present, the existing facilities (i.e. the campground and readily accessible back-country sites) are operating at full capacity during peak vacation periods (holiday weekends). More people may wish to use the Park during this time, but because they have come to realize that there will be a waiting list, or they may not be able to camp at all, do not bother. The data would indicate, however, that off-season and shoulder use may increase.

The majority of Park users will continue to come from the 150 km radius around the Park; there will be a larger segment of older, better educated persons, who may show more interest in the natural environment but may not be interested in physically very demanding recreational activities.

The non-resident visitation to Kejimkujik will probably remain about the same in terms of actual numbers. Use of the Park by this segment will depend very largely on the economic trends within Canada and the United States in the future.

Increased growth of the population at nearby urban areas could well cause an increase in demand for outdoor recreation at Kejimkujik.

Management Concerns, Recommendations, and Research Requirements

Management concerns for Visitor Services include:

1. Backcountry site assessment. The entire backcountry area requires vegetation/soil assessment to identify potential backcountry campsites. This information, coupled with visitor requirements, would provide a listing of suitable areas for sites. The present backcountry rehabilitation program involves closing impacted sites, and if present visitor demand continues, additional campsites will be required. No funds have been identified to date.

2. Group Campground Rehabilitation. This facility is heavily impacted due to inappropriate site design. Funding for its rehabilitation is identified for 1989. To prevent further deterioration, an environmental ethics and use program (video and slides) should be prepared immediately.

3. Backcountry Trail/Campsite Plan. Walking and hiking are identified by 90% and 60% of visitors respectively. as being important for their Park visit (VAMP, 1983). The present trail system is inadequate. A backcountry Trail Plan for the southern area of the Park is especially critical as hiking demand cannot be met by present facilities.

4. Cross-country Ski Trail System Plan. The present ski trails are summer roadways or hiking trails. A ski trail plan is required for the Park that would incorporate the needs of the visitor (shelter, accommodation, etc.) and the protection of Park resources.

5. Information on Visitors. The 1983 Visitor Survey was detailed; however, it addressed only visitor use in the summer months. Visitor data is required for the fall, winter and spring seasons in addition to non-user data (potential visitors) and an ongoing visitor data program initiated.

6. Jeremys Bay Campground Impact. At present, the campground is showing moderate levels of impact. It will deteriorate with further use. A continual program of vegetation or tree planting, coupled with due conservation treatment and an environmental education program, is required.

7. Day Use Areas. The present areas (Mill Falls, Mersey River and Merrymakedge) need trail definition and site improvements.

8. Bicycles. A Bicycle Use Plan should be developed for the Park which would include day visitors as well as Jeremys Bay campers.

9. Backcountry Patrol. At present, inadequate resources are available for backcountry patrol. With 8,000 visitor nights being recorded annually, this coverage is essential for visitor safety and protection.

Limitations for Use

At present the Jeremys Bay Campground, Jim Charles Group Campground, Backcountry Campsites, Winter Picnic Facilities and ski trails are at full capacity during peak times.

The backcountry site assessment would probably show that additional backcountry campsites could be added (west side, on Kejimkujik Lake, Peskowesk Lake, Hilchemakaar and Silver Lake, etc.).

Capacity at the Jim Charles Group Campground should be reduced for both visitor enjoyment and resource protection. This will be addressed in the site's rehabilitation plan.

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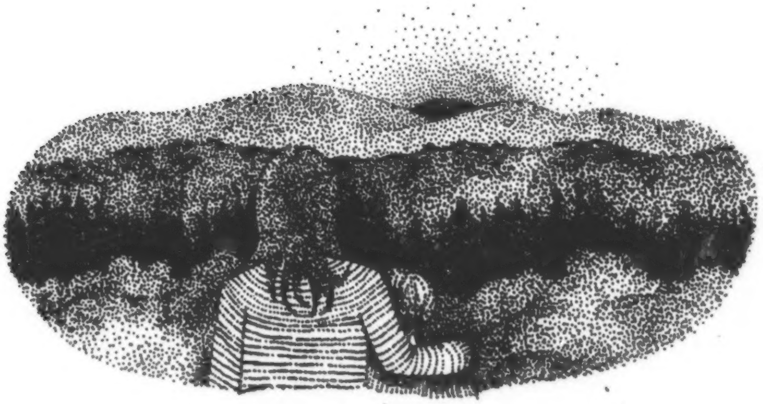

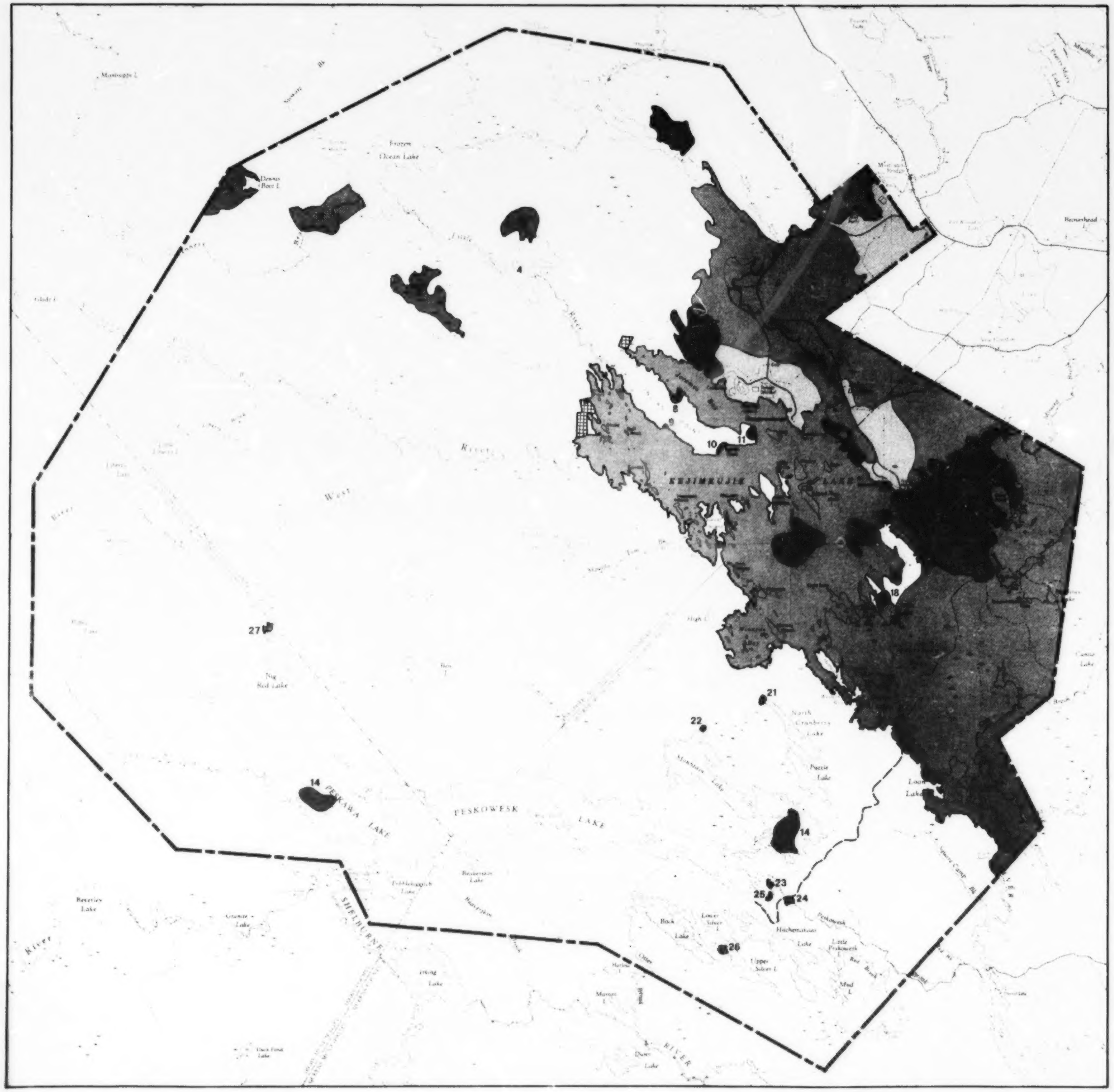

KEJIMKUJIK

NATIONAL PARK

LAND USE ZONING

■ Class 1 Special Areas

□ Class 2 Wilderness Recreation Areas

■ Class 3 Natural Environment Areas

░ Class 4 General Outdoor Recreation Area

Features that are rare, outstanding or endangered and that are sensitive to visitor use activities are designated as Class I areas. These areas warrant some degree of protection not required elsewhere in the Park. Protection measures may include visitor use restrictions and the application of resource management prescriptions. Appropriate visitor opportunities include nature observation and interpretation. The nature of each of the twenty-seven Class I areas is described on the Resource Value Areas map.

In the Class II areas the primary aim is to protect landscapes and resource processes representative of the Atlantic Coast Uplands Natural Region, and to provide wilderness recreational opportunities compatible with protection of the area. These opportunities include canoeing, hiking, skiing and wilderness camping. Travel is to be by non-motorized means. The resources in Class II areas are allowed to evolve naturally.

Class III areas are natural environments that provide for intermediate levels of outdoor recreation opportunities. These opportunities include hiking, bicycling, and skiing. Interpretive trails, low speed scenic roads, and motorized water travel are appropriate. Resource management techniques may be applied in order to improve the habitat for some faunal species or to insure the continuation of a diversity of types of vegetation in the Park, though normally no management will be undertaken.

Areas that are or may be used for recreational opportunities requiring intensive facility development or that are used for Park administration are designated as Class IV. Appropriate facilities include semi-serviced campsites, supervised beaches, serviced picnic areas, and admistration facilities. Resources will be managed to ensure that high quality recreation and interpretive opportunities are maintained.

In two instances an existing land use has been identified as non-conforming to the classification applied, and yet removal of the land use is not desirable. The non-conforming uses are related to the Peskowesk Road where it passes through the Grafton Lake Class I area and where it passes through the Class II area below the Lower Mersey River (to be open to vehicular traffic only in spring and fall). Strategies will be applied to minimize the impact of these non-conforming uses on the remainder of the zone. The road is shown on the maps as a dashed line where it is non-conforming.

▦ Indian lands

Indian and Northern Affairs
Parks Canada
Atlantic Region Planning

Scale
0 1 2 Miles
0 1600 3200 Metres